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# T-BERD 310
# COMMUNICATIONS ANALYZER
# REFERENCE MANUAL

DECEMBER 1992

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# SECTION 1
# GENERAL INFORMATION

# GENERAL INFORMATION

## 1.1 INTRODUCTION

This section provides an overview of the standard and optional features of the Telecommunications Techniques Corporation (TTC) T-BERD 310 Communications Analyzer. It also provides information on T-BERD 310 accessories and cables.

In addition to this manual, a *T-BERD 310 User's Guide* provides information on setting up and operating the T-BERD 310 in a number of in-service and out-of-service applications.

## 1.2 INSTRUMENT OVERVIEW

The T-BERD 310 is a portable test instrument that can test and analyze DS3 transmission systems from DS3 access points during circuit installation, acceptance testing, and fault isolation. The T-BERD 310 can either generate and receive test patterns for out-of-service testing, or monitor DS3 circuits without service interruption. Options can be added which enable the T-BERD 310 to perform DS1 testing, insert a DS1 channel into a live DS3 line, drop E1 channels, and drop DS3 and DS1 payloads from SONET signals. The following information describes the standard and optional features of the T-BERD 310.

### 1.2.1 Standard Features

The T-BERD 310 offers the following standard features:

**Simple user interface** allows DS3 circuit testing using unframed, M13 framed, C-bit parity framed, multiplexed (channelized) M13 framed, multiplexed C-bit parity framed, and THRU mode formatting.

**Multiplexed C-Bit parity and M13 framed operating modes** enable the T-BERD 310 to insert DS1 D4 or ESF formatted test patterns or loop codes into the DS3 signal.

**Automatic configuration mode** allows the T-BERD 310 to configure itself automatically to the received DS3 signal framing and pattern.

**Standard and programmable DS3 test patterns** are selectable from a front-panel switch.

**Five side-panel DS3 outputs** provide the same signal as the front-panel output jack.

**Simultaneous test result accumulation** minimizes the time needed to test for logic errors, BPVs, M13, C-bit parity and frame errors, performance analysis (errored and error-free seconds), and signal measurements (frequency, signal loss time, power, and pulse shape).

**A SUMMARY test results category** displays key non-zero and "out-of-spec" test results, eliminating the need to search through long lists of test results.

**Pulse shape analysis** measures the height, width, rise time, and fall time of the DS3 pulse. The pulse shape can be compared to pulse shape specifications outlined in the proposed CCITT G.703 and the ANSI T1.102-1991 specifications. A pulse shape graph showing the pulse shape and pulse shape mask can also be printed on a graphics compatible printer (e.g., the TTC PR-40A Thermal Printer).

**Pattern slips** can be counted between the transmitted and received signal by testing the circuit with pseudorandom test patterns.

**Logic error, BPV, and frame error insertion capabilities** enable the T-BERD 310 to simulate errors as they occur. Errors can be inserted singly, in bursts at preselected durations and error rates, or continuously at preselected error rates.

**Connecting a printer** to the T-BERD 310 allows generation of test results, signal status, and alarm messages, front-panel switch configurations, and pulse shape graphs. The T-BERD 310 comes equipped with an RS-232-C serial interface or optional IEEE-488 interface (310-6 IEEE-488 Option).

**An internal 20-kbyte print buffer** allows printouts to be stored until a printer is connected to the T-BERD 310. The print buffer is battery-backed which allows power to be turned off without losing the printout information.

**Customized test *result* printouts** can be created for specific tests.

**Remote control operation** enables the T-BERD 310 to be installed at a remote location or in a manufacturing test facility. An RS-232-C serial interface or optional IEEE-488 interface (310-6 IEEE-488 Option) is available for remote control operation.

**Multiple displays** enable the operating mode, test pattern, and two test results to be displayed on the front panel at the same time.

**Audible alarms** can be used to indicate pattern synchronization, threshold errored seconds, and any other error event.

**DS1 channels can be dropped** from a DS3 signal to the 310-1 DS1/DS0 Analyzer Option or an external DS1 test set.

**DS2 frame synchronization and loss detection** LEDs provide status and alarm indications on the front panel.

**Far-End Alarm and Control (FEAC) messages** can be monitored and displayed on the front panel and reported in a printout. FEAC messages can also be selected and transmitted from the T-BERD 310.

### 1.2.2 Optional Features

The following optional features are available for the T-BERD 310. Unless otherwise indicated, the T-BERD 310 can be upgraded in the field with one or more of the options. Contact TTC for additional information on upgrading the T-BERD 310 at (800) 638-2049.

#### 310-1 DS1/DS0 Analyzer Option

The user-installed 310-1 DS1/DS0 Analyzer Option allows the T-BERD 310 to test and analyze DS1 and DS0 channels from either a DS3 or DS1 access point. A user interface is housed in the T-BERD 310 front cover allowing easy access and control over the DS1/DS0 analyzer. This option provides DS1 (input and output), datalink (ESF, ZBTSI (optional), and SLC), DS0, and VF signal access through the T-BERD 310 side panel. Refer to Section 6 for a complete description of this option.

#### 310-2 E1 Drop Option

The user-installed 310-2 E1 Drop Option enables the T-BERD 310 to drop both DS1 and E1 channels from the DS3 signal. This option adds a 3-pin banana jack to the side panel. The DS1 channels can be analyzed with the 310-1 DS1/DS0 Analyzer Option or an external DS1 test set, such as the TTC T-BERD 211. The E1 channels can be analyzed by an external E1 test set, such as the TTC INTERCEPTOR 1402 Communications Analyzer. Refer to Section 9 for a complete description of this option.

### 310-3 DS1 Insert Option

The user-installed 310-3 DS1 Insert Option enables the T-BERD 310 to insert a DS1 channel into a live DS3 signal without affecting the DS3 signal or the other 27 DS1 channels. This option provides a secondary DS3 receiver and a DS1 input. The secondary DS3 receiver allows the DS3 signal to pass through the T-BERD 310 and accommodate the insertion of the DS1 channel. The secondary DS3 signal can be monitored from the front panel and tested for in-service BPV, frame, M13 parity, C-bit parity, FEBE errors, and the received frequency. The secondary DS3 receiver also enables the T-BERD 310 to perform full-duplex (bidirectional) in-service monitoring of a DS3 line. The DS1 input allows a DS1 channel to be inserted from an external DS1 source. A DS1 channel can also be inserted from the 310-1 DS1/DS0 Analyzer Option. Refer to Section 7 for a complete description of this option.

### 310-4 SONET Drop (STS-1) Option

The user-installed 310-4 SONET Drop (STS-1) Option enables the T-BERD 310 to drop and analyze SONET DS3 and DS1 (VT1.5) payloads and SONET overhead at a Synchronous Transport Signal level 1 (STS-1) source. The option provides an STS-1 input connection. SONET level test results are also provided to analyze the section, line, and path bit interleave parity (BIP) errors, frame word errors, pointer justification counts, SONET received frequency, and automatic protection switching (APS) counts. The SONET DS3 payload and SONET overhead are analyzed by the T-BERD 310. The SONET DS1 payload can be dropped out and analyzed by the 310-1 DS1/DS0 Analyzer Option or an external DS1 test set. Refer to Section 8 for a complete description of this option.

### 310-4A SONET Drop (STS-1, OC-1/3) Option

The user-installed 310-4A SONET Drop (STS-1, OC-1/3) Option enables the T-BERD 310 to drop and analyze SONET DS3 and DS1 (VT1.5) payloads and SONET overhead from Optical Carrier level 1 (OC-1), level 3 (OC-3), and STS-1 sources. The option provides an OC–1 and OC-3 optical input connection as well as an STS-1 input connection. SONET level test results are also provided to analyze the section, line, and path bit interleave parity (BIP) errors, frame word errors, pointer justification counts, SONET received frequency, and automatic protection switching (APS) counts. The SONET DS3 payload and SONET overhead are analyzed by the T-BERD 310. The SONET DS1 payload can be dropped out and analyzed by the 310-1 DS1/DS0 Analyzer Option or an external DS1 test set. Refer to Section 8 for a complete description of this option.

**NOTE:** The 310-4 and 310-4A options *cannot* be installed in the T-BERD 310 at the same time.

### 310-5 DS3 Jitter Option

The user-installed 310-5 DS3 Jitter Option enables the T-BERD 310 to measure the DS3 signal for wideband and highband jitter. The option provides test results that measure the current wideband and highband peak-to-peak jitter and the maximum wideband and highband peak-to-peak jitter since the start of the test. The results are presented in Unit Intervals (UIs). The option also provides an output that can drive an external spectrum analyzer to determine the amplitude and frequency components of the jitter. Refer to Section 10 for a complete description of this option.

### 310-6 IEEE-488 Option

The user-installed 310-6 IEEE-488 Option enables the T-BERD 310 to communicate with IEEE-488 compatible devices. This option adds an IEEE-488 interface which complies with the IEEE Standard Interface for Programmable Instrumentation (STD 488-1978) standard. This interface offers both addressable and talk-only operating modes for remote control and printer operation. Refer to Sections 4 and 5 for a complete description of this option.

### 310-7 220 V Option

The factory-installed 310-7 220 V Option configures the T-BERD 310 with a 220 VAC power supply.

### 310-8 358 Connector Option

The factory-installed 310-8 358 Connector Option configures the T-BERD 310 with WECO 358 jacks; replacing the WECO 560A jacks.

### 310-9A Enhanced ESF/DS1 Timing Slips Option

The user-installed 310-9A Enhanced ESF/DS1 Timing Option adds the following functions to the 310-1 DS1/DS0 Analyzer Option.

- Test and analyze the ESF and ZBTSI datalink ANSI T1.403 Performance Report Messages (PRM).

- Generate PRMs on the transmitted signal which are based on the received DS1 signal.
- Generate ESF and ESFz out-of-band loop codes.
- Adds the ESFz operating mode which enables the 310-1 to test and analyze ZBTSI-encoded (Zero Byte Time Slot Interchange) ESF circuits.
- Adds the DS1 timing slip test result which enables the 310-1 to measure bit and frame slips between two DS1 signals.

Refer to Section 6 for a complete description of this option.

### 310-10 G.821 Results Option

The factory-installed 310-10 G.821 Results Option adds the CCITT Recommendation G.821 performance analysis test results to the T-BERD 310 and 310-1 DS1/DS0 Analyzer Option. The G.821 results include available seconds, % available seconds, severely errored seconds (except the 310-1), % severely errored seconds, consecutive severely errored seconds (except the 310-1), degraded minutes, % degraded minutes, and unavailable seconds.

## 1.3 ACCESSORIES AND CABLES

Table 1-1 lists the available accessories for the T-BERD 310. Table 1-2 lists the available cables for the T-BERD 310. Contact TTC for additional information on accessories and cables at (800) 638-2049.

**Table 1-1**
**T-BERD 310 Accessories**

| Model | Description |
|---|---|
| PR-40A | Thermal Printer |
| PR-35 | Rack Mount Printer |
| 41846-01 | 19" Rack Mount for the T-BERD 310 |
| 41846-02 | 23" Adaptor Kit for the T-BERD 310 |
| 41855-01 | 19" Rack Mount for the 310-1 |
| 41855-02 | 23" Adaptor Kit for the 310-1 |
| 41306-02 | Soft Carrying Case |

Table 1-2
T-BERD 310 Cables

| Model | Description |
|---|---|
| 30598-01 | 440A to 440A adaptor (10') |
| 30598-02 | 440A to 440A adaptor (1') |
| 30599 | 440A to 358 adaptor (10') |
| 10830 | 440A to BNC adaptor |
| 10831 | 358 to BNC adaptor |
| 30662 | BNC to BNC, cable (6') |
| 30767 | BNC to push-on jack cable (10') |
| 30687 | 3-pin banana to 3-pin banana (10') |
| 10420 | WECO 310 to WECO 310 (10') |
| 10598 | WECO 310 to WECO 310 (4') |
| 10559 | WECO 310 to bantam (10') |
| 10599 | WECO 310 to bantam (4') |
| 30914 | WECO 310 to bantam (6') |
| 10558 | WECO 310 to alligator (10') |
| 30697 | WECO 310 to mini-test clips (6') |
| 2002 | FC(PC) singlemode fiber optic (3 m) |

# SECTION 2
# INSTRUMENT CHECKOUT AND SERVICE

# INSTRUMENT CHECKOUT AND SERVICE

## 2.1 INTRODUCTION

This section provides information on preparing the T-BERD 310 for use. Specifically included are instructions for unpacking and inspecting the instrument; a list of the equipment contained in the shipment; and an instrument checkout procedure. The checkout procedure can be used to check the electrical performance of the T-BERD 310 after unpacking and initial inspection. This section also includes information on maintenance and service of the T-BERD 310. After you have familiarized yourself with the instrument, refer to Section 3 for more information on the front- and side-panel controls, indicators, and connections.

## 2.2 UNPACKING AND INITIAL INSPECTION

The T-BERD 310 shipping container should be inspected for the equipment included with the shipment (see Section 2.3) and for any signs of damage. If the shipping container or shipping material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument is checked mechanically and electrically. The electrical performance of the instrument can be checked by performing the instrument checkout procedure in Section 2.7. If the contents of the shipment are incomplete or if the T-BERD 310 does not pass the checkout procedure, notify TTC Customer Service at (800) 638-2049. If the shipping container is damaged, notify the carrier and TTC. Keep the shipping container and materials for the carrier's inspection.

## 2.3 EQUIPMENT INCLUDED

The following items should be present when the T-BERD 310 is received and unpacked.

- T-BERD 310 Communications Analyzer with front-panel cover
- 3-prong AC line cord
- Operating manual

- 1-foot loopback cable
- Snap-on pouch and help cards

Check the purchase order against the rear-panel option stickers to verify that the ordered options are installed.

## 2.4 WARNINGS

The following warnings must be observed before and during all phases of instrument operation. Failure to comply with these and other specific warnings contained elsewhere in this manual may cause physical harm to the operator and/or damage to the instrument. TTC assumes no liability due to the customer's failure to comply with these requirements.

### GROUND THE INSTRUMENT

To minimize shock hazard, the instrument chassis must be connected to an approved 3-contact electrical outlet or used with a 3-contact to 2-contact adaptor with the grounding wire firmly connected to an electrical ground at the power outlet.

### KEEP AWAY FROM LIVE VOLTAGES

Do not remove the instrument's top cover or insert fingers or other objects through the side panel holes while power is applied.

### DO NOT OPERATE IN AN AMBIENT TEMPERATURE ABOVE 122°F (50°C)

Do not operate the instrument in ambient temperatures that exceed 122°F (50°C). Operating this unit in temperatures above 122°F (50°C) can cause damage to the instrument.

### REPLACE BLOWN AC FUSE WITH A PROPERLY RATED FUSE

Do not operate the instrument with an improperly rated AC fuse. An improperly rated fuse can cause damage to the instrument.

## 2.5 POWER REQUIREMENTS

The standard T-BERD 310 is configured with a single phase, 120 VAC, 50/60 Hz power supply. The T-BERD 310 can also be configured with a factory installed single phase, 220 VAC, 50/60 Hz power supply. Refer to Section 2.8.2 for more information on fuse requirements and replacement.

## 2.6 SETTING UP THE T-BERD 310

The following procedure describes how to setup the T-BERD 310.

### 2.6.1 Opening the T-BERD 310

1. **Set the instrument on a flat surface**

2. **Raise the front of the instrument (see Figure 2-1)**
   Extend the two bottom front feet to raise the front panel up for better viewing and allow the front cover to be opened.

3. **Press down on the two front-cover buttons and open the cover**
   The cover is designed to lay flat on the table while still attached to the instrument. If the 310-1 DS1/DS0 Analyzer Option is installed in the cover, the cover should remain attached to the instrument.

4. **Connect the AC power cord on the side panel**
   Verify that the **AC Power** switch is set to OFF (the "0" side is down) before connecting the power cord to an AC outlet.

5. **Press the AC Power switch (the "1" side is down) to turn the power ON**
   During an initial power-up sequence, the instrument performs a diagnostic self-test that is described in Section 2.6.2.

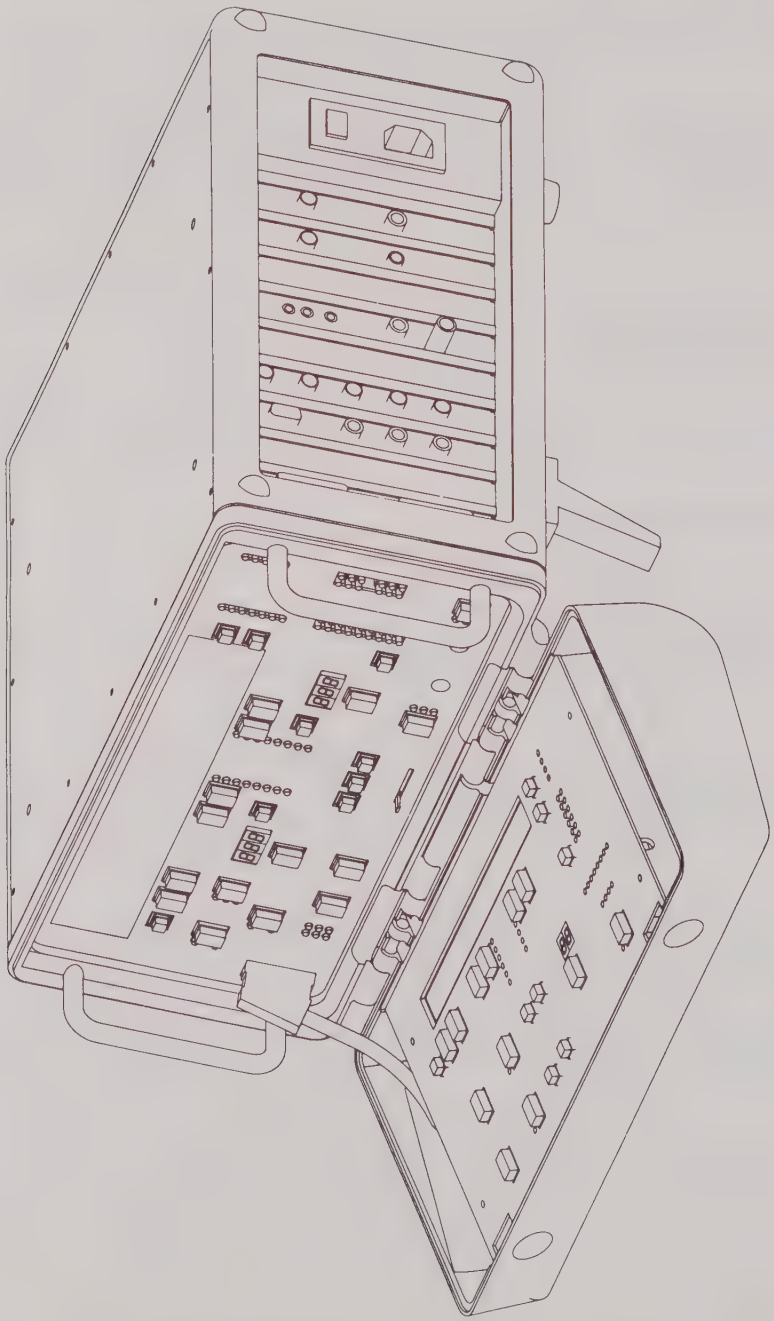


**Figure 2-1**
**Opening the T-BERD 310**

### 2.6.2 Power-Up Self-Test

The instrument performs the following diagnostic self-test upon power-up:

- All front-panel LEDs momentarily illuminate. This provides a visual inspection of the LEDs. If an LED is burned out, make note of it. A burned-out LED does not affect normal operation.

- All front-panel switches are checked. If a switch is found to be stuck in an active position, a message is displayed (see Appendix B) indicating a switch is stuck. A switch identified as stuck becomes inoperative.

- The instrument configuration stored in the NOVRAM data is checked. If the data has not changed since the last power down, the instrument is configured accordingly. If errors are found in the NOVRAM data, the message "RELOADING NOVRAM" is displayed, the factory default settings are reloaded, and the front panel is configured accordingly. The T-BERD 310 remains fully functional even though the instrument configuration may not have been saved during the power cycle. While the instrument may be used, TTC should be called for service at (800) 638-2049.

- The internal components are checked. If faults are found in the internal components, specific messages are displayed. In the event that a self-test error message is displayed, record the message and call TTC for assistance. There are no user-serviceable parts in the T-BERD 310, except the fuse located on the side panel.

- The pulse shape measurement capability is calibrated.

After successfully completing the self-test, the T-BERD 310 is configured with the data stored in NOVRAM. Until a DS3 signal is detected, the Status and Alarm LEDs are not illuminated; except for the Power Loss LED.

Pressing and holding the **RESTART** switch for two seconds during power-up clears the non-volatile RAM (NOVRAM), and resets the instrument configuration to the factory default settings (see Appendix A and Figure 2-2). Press the **RESTART** switch until the message "Reloading NOVRAM" is displayed. If the **MODE** switch is pressed during power-up, the current software and hardware versions are displayed. Pressing the **MODE** switch down arrow a number of times scrolls a list of the installed printed circuit (PC) board names and modules (standard and optional) in the display. When the last PC board name is scrolled past, the power-up sequence continues.

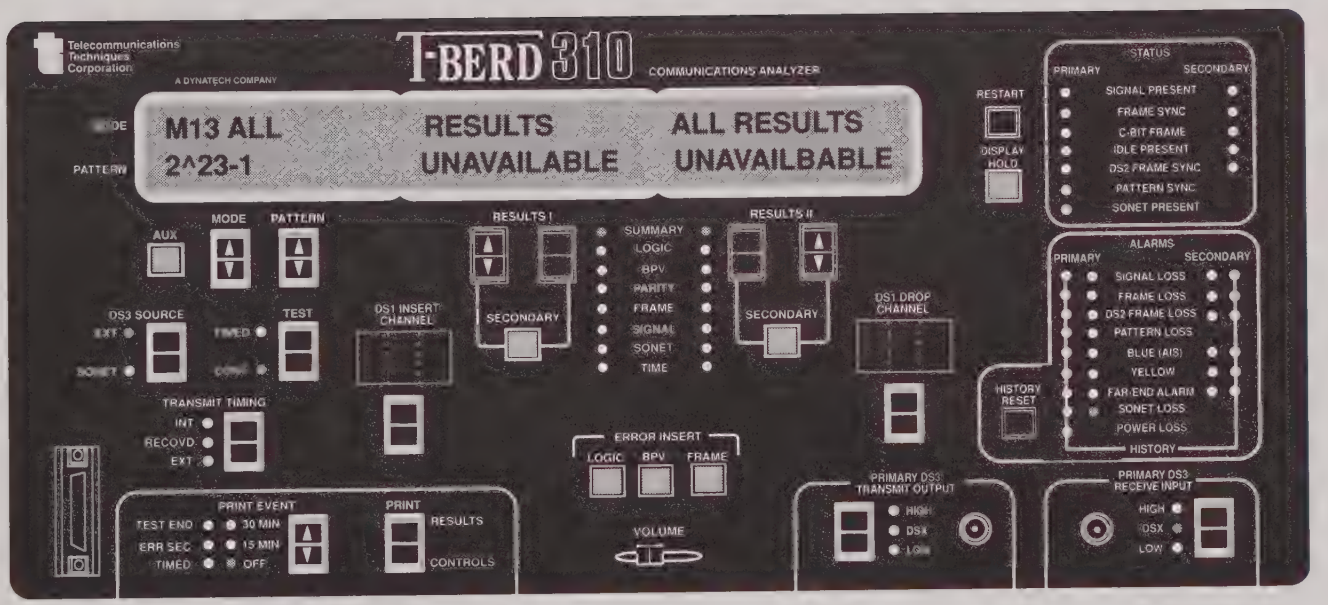



Figure 2-2
Front Panel After Power-Up

## 2.7 INSTRUMENT CHECKOUT

After unpacking, the T-BERD 310 should be checked for proper electrical operation. If any of the following steps fail, repeat the step. If the procedure continues to fail, contact TTC Customer Service at (800) 638-2049. Perform the following checkout procedure.

1. **Instrument setup**
   Perform the procedure in Section 2.6.1 to set up the instrument. Press the **RESTART** switch when applying power in Step 5 of Section 2.6.1 to configure the instrument with the factory default settings (see Appendix A).

2. **Power-up self-test**
   Refer to Section 2.6.2 to verify successful power-up. If an error message appears during the self-test procedure, refer to Appendix B for corrective action.

3. **DS3 loopback cable**
   Plug the supplied loopback cable into the front-panel PRIMARY DS3 TRANSMIT OUTPUT and PRIMARY DS3 RECEIVE INPUT jacks.

4. **RESTART switch**
   Press this switch to clear any results appearing in the RESULTS windows and to restart the test.

5. **Primary Status LEDs**
   Verify that the green Primary Status LEDs — Signal Present, Frame Sync, and Pattern Sync — illuminate and the RESULTS windows indicate "ALL RESULTS OK".

6. **Unplug loopback cable**
   Verify that the Primary Status LEDs — Signal Present, Frame Sync, and Pattern Sync — are *not* illuminated. The RESULTS windows may indicate errors, e.g., BIT ERRORS. The red Primary Alarm LEDs — Signal Loss, Frame Loss, and Pattern Loss — illuminate (right column of LEDs under Primary Alarms).

7. **Plug in loopback cable**
   Verify that the Primary Status LEDs — Signal Present, Frame Sync, and Pattern Sync — illuminate. The RESULTS windows may indicate errors, e.g., BIT ERRORS (an increase in the count may occur). The Primary Alarm LEDs — Signal Loss, Frame Loss, and Pattern Loss — are *not* illuminated. However, the Primary Alarm History LEDs — Signal Loss, Frame Loss, and Pattern Loss — are illuminated (left column of LEDs under Primary Alarms).

8. **RESTART switch**
   Press this switch to clear any results appearing in the RESULTS windows, the Primary Alarm History LEDs, and restart the test. Verify that the Primary Status LEDs — Signal Present, Frame Sync, and Pattern Sync — illuminate and the RESULTS windows indicate "ALL RESULTS OK".

9. **LOGIC ERROR INSERT switch**
   Press this switch for less than one second. A single logic error is inserted into the transmitted signal. Verify the receipt of the logic error in the RESULTS windows. The logic error can appear in the BIT ERRORS, PAR ERRORS, or FRM ERRORS result. If the result is not in the RESULTS I window, press the **RESULTS I Results** switch (**RESULTS I** switch with arrows) to scroll through the SUMMARY category. Press the **LOGIC ERROR INSERT** switch several more times to increment the error count.

10. **BPV ERROR INSERT switch**
    Press this switch for less than one second. A single BPV is inserted into the transmitted signal. Verify the receipt of the BPV in the RESULTS windows; VIOLATIONS equals one. If the VIOLATIONS result is not in the RESULTS I window, press the **RESULTS I Results** switch to scroll through the SUMMARY category and check for additional results. Press the **BPV ERROR INSERT** switch several more times to increment the error count.

11. **FRAME ERROR INSERT switch**
    Press this switch for less than one second. A single frame error is inserted into the transmitted signal. Verify the receipt of the frame error in the RESULTS windows; FRM ERRORS equals one. If the FRM ERRORS result is not in the RESULTS I window, press the **RESULTS I Results** switch to scroll through the SUMMARY category and check for additional results. Press the **FRAME ERROR INSERT** switch several more times to increment the error count.

12. **RESULTS I Results switch**
    Press this switch to verify that the results are displayed and make note of any others. The SUMMARY category displays specific non-zero or out-of-specification results.

## 2.8 MAINTENANCE AND SERVICE

This section describes the steps to take should you have trouble operating the T-BERD 310. Instructions for replacing the instrument line fuse are also included, along with a description of the TTC warranty policies and repair procedures.

### 2.8.1 In Case of Difficulty

If the T-BERD 310 fails to operate and no front-panel indicators illuminate:

- Check the AC power cord to ensure that it is securely connected to the T-BERD 310.
- Make sure that the power supply is uninterrupted by plugging another electrical device into the electrical outlet used by the T-BERD 310.
- Verify that a proper, working AC line fuse is installed. Information on the fuse-type and installation is given in Section 2.8.2.

If the T-BERD 310 fails to operate after determining the AC power cord, power source, and fuse are working properly, contact the TTC Customer Service Department at: (800) 638-2049.

If the front-panel indicators illuminate, but the instrument does not operate properly:

- Use the instrument checkout procedure in Section 2.7 to localize the problem.
- Note the areas where the self-test failed, then contact TTC for assistance.

### 2.8.2 AC Line Fuse Replacement

The T-BERD 310 AC line fuse is stored in the AC fuse receptacle located just below the **AC Power** switch. If the fuse is open, it should be replaced with a 5A, 250V, Slo-Blo fuse (Littlefuse #218001 or its equivalent). Always use the correct fuse rating.

To replace the AC line fuse, perform the following:

1. Locate the tab on the fuse cover above the **AC Power** switch receptacle.
2. Using a small screwdriver or similar instrument, gently pry the fuse cover open.
3. Remove the old fuse and install a new fuse of the correct size.
4. Press the plastic fuse holder securely back into place.

### 2.8.3 Warranty Policy

All equipment manufactured by Telecommunications Techniques Corporation (TTC) is warranted against defects in material and workmanship. This warranty applies only to the original purchaser and is non-transferable unless express written authorization of the warranty transfer is granted by TTC.

Liability under this warranty extends only to the replacement value of the equipment. The warranty is void under the following conditions.

1. Equipment has been altered or repaired without specific authorization from TTC.

2. Equipment is installed other than according to instructions contained in TTC literature and operating manuals.

No other warranty is expressed or implied. TTC is not liable for consequential damages.

### 2.8.4 In-Warranty Service

Equipment being serviced or repaired under warranty must be returned to the factory with shipping prepaid. The equipment should be packed and shipped according to the instructions in Section 2.8.6. Before returning any equipment, the customer must obtain a Return Authorization (RA) number by contacting the TTC Repair Department. The RA number should then appear on all paperwork and be clearly marked on the outside of the shipping container.

After the equipment is repaired by TTC, it will be tested to applicable specifications, burned-in for at least 24 hours, retested, and returned to the customer with shipping prepaid. A brief description of the work performed and the materials used will be provided on the Equipment Repair Report furnished with the returned equipment.

### 2.8.5 Out-of-Warranty Service

The procedure for repairing out-of-warranty equipment is the same as that used for equipment still under warranty. However, there is a minimum charge applied to each request for out-of-warranty service. The minimum charge guarantees the customer an estimate of the repair costs and is used as credit against actual materials and labor costs should the equipment be repaired. Contact the TTC Repair Department for specific information on the minimum out-of-warranty charge.

The customer will be billed for parts plus standard labor rates in effect at the time of repair. The customer will also be required to furnish a purchase order number before repair work can be started, and a hard copy of the purchase order must be received by TTC before the repaired equipment can be shipped to the customer. A description of the labor and materials used will be provided in the Equipment Repair Report.

Once an out-of-warranty repair is made, the repaired part or component is warranted for 90 days. This warranty applies only to the part or component that was repaired; other parts or components are not covered under the 90-day repair warranty.

### 2.8.6 Equipment Return Instructions

To all equipment returned for repair, the customer should attach a tag that includes the following information.

1. Owner's name and address.
2. A list of the equipment being returned and the applicable serial number(s).
3. A detailed description of the problem or service requested.
4. The name and telephone number of the person to contact regarding questions about the repair.
5. The Return Authorization (RA) number.

It is recommended that all switches be left in the positions they were in when the problem occurred. This is requested so that the TTC repair group can analyze the switch positions along with a detailed description of the problem or of the service requested.

If possible, the customer should return the equipment using the original shipping container and material. If the original container is not available, the unit should be carefully packed so that it will not be damaged in transit. TTC is not liable for any damage that may occur during shipping. The customer should clearly mark the TTC-issued RA number on the outside of the package and ship it prepaid and insured to TTC.

# SECTION 3
# INSTRUMENT DESCRIPTION

# INSTRUMENT DESCRIPTION

## 3.1 INTRODUCTION

This section describes the controls, indicators, connections, and test results used to set up and operate the T-BERD 310 (see Figure 3-1).

NOTE: Throughout this section, a number appears after each control name. These numbers match the callouts in Figure 3-1 and can be used to quickly locate switches and indicators.

The descriptions of switches, indicators, and connectors are presented in the following subsections.

**Initial Test Setup** — Section 3.2 explains the front-panel controls and indicators used to initially configure the T-BERD 310 for the circuit being tested.

**Test Connections** — Section 3.3 explains the available connections for the T-BERD 310.

**Signal Verification** — Section 3.4 explains the controls, indicators, and test results used to verify that the T-BERD 310 has properly acquired the received signal.

**Starting and Running the Test** — Section 3.5 explains the controls and indicators used to start and run a test.

**Collecting Test Results** — Section 3.6 explains the controls and indicators used to view, collect, and analyze the test results.

**Printing the Test Setup and Results** — Section 3.7 explains the controls and indicators used to store and print test results and front-panel configurations.

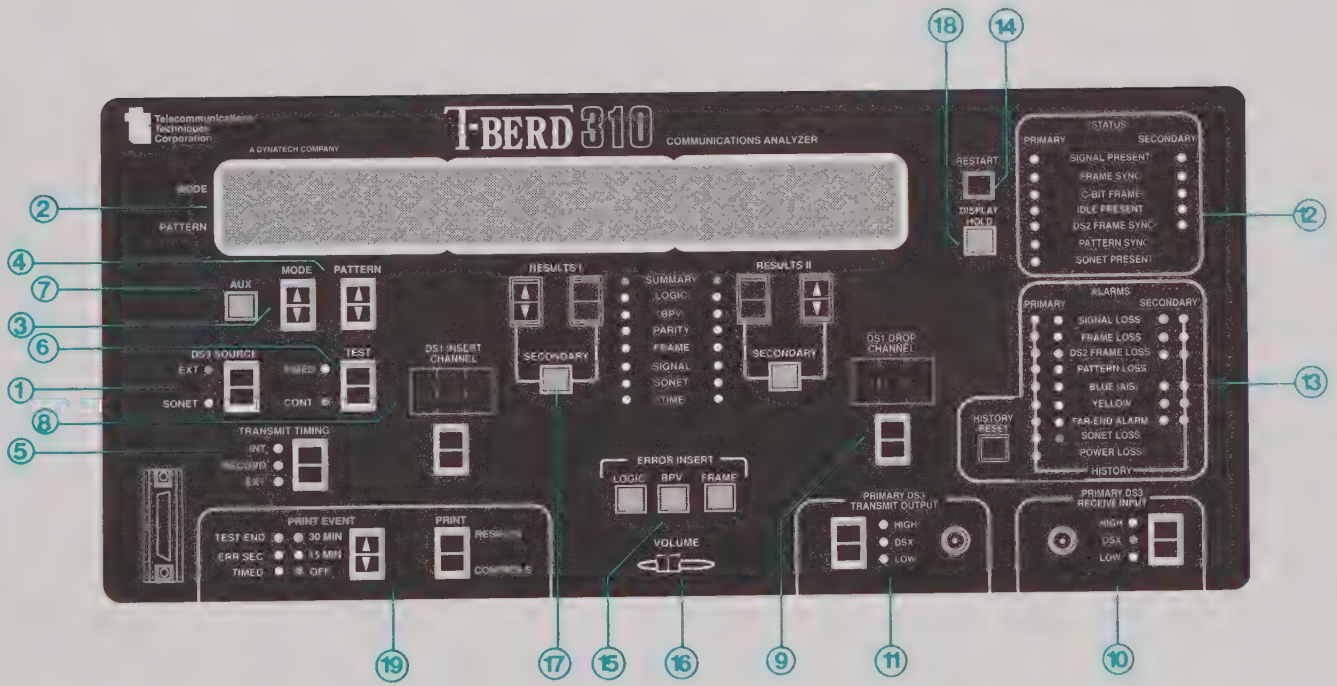



Figure 3-1
T-BERD 310 Front Panel

## 3.2 INITIAL TEST SETUP

This section describes the controls and indicators (see Figure 3-2) used to initially configure the T-BERD 310 to test a circuit from a DS3 access point. The following controls and indicators are described in the order that you would normally use them.

- Help card
- **DS3 SOURCE** switch (1)
- Front-panel display (2)
- **MODE** switch (3)
- **PATTERN** switch (4)
- **TRANSMIT TIMING** switch (5)
- **TEST** switch (6)
- **AUX** switch (7)
- **DS1 INSERT CHANNEL** switch (8)
- **DS1 DROP CHANNEL** switch (9)

### 3.2.1 Help Cards

The help cards are located under the storage pouch. Side one provides a quick reference to the T-BERD 310 modes, patterns, auxiliary functions, and results. Side two provides a functional block diagram of the T-BERD 310 mainframe and options (see Appendix C). If the 310-1 DS1/DS0 Analyzer Option is installed, an additional 310-1 help card is provided.

### 3.2.2 DS3 SOURCE Switch (1)

The **DS3 SOURCE** switch is used to select the DS3 signal from either a side-panel SONET input signal or front-panel DS3 input signal. The switch is functional only when a SONET drop option is installed (see Section 8). The switch selections include:

**EXT** — Selects the PRIMARY DS3 RECEIVE INPUT jack as the DS3 input source.

**SONET** — Selects one of the side-panel SONET input connections as the DS3 source.

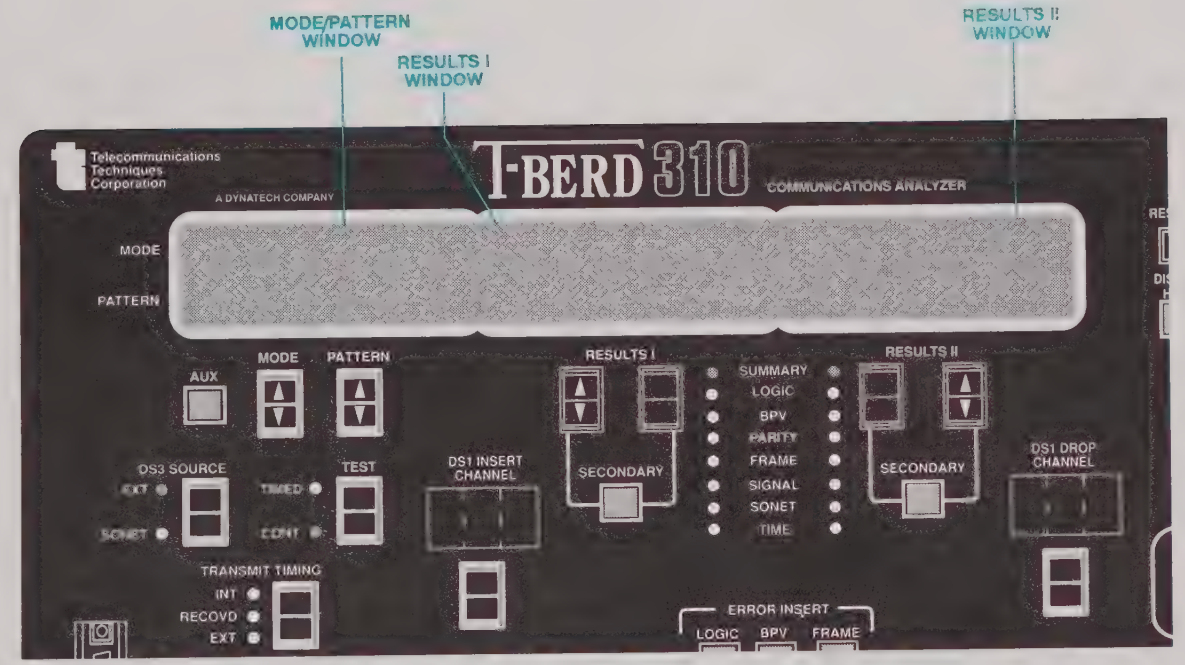



Figure 3-2
Test Setup Controls and Indicators

### 3.2.3 Front-Panel Display (2)

Operating modes, test patterns, results, and auxiliary functions are viewed in the display shown in Figure 3-2. The display is divided into three 2-line windows. The left window indicates the current operating mode (top line labeled MODE) and test pattern (bottom line labeled PATTERN). The operating mode and test pattern are selected by pressing the **MODE** and **PATTERN** switches. The other two windows, identified as RESULTS I and RESULTS II, display the results and instrument status messages. The RESULTS windows are controlled by the **RESULTS** switches.

All three windows of the front-panel display are used to configure the auxiliary functions (**AUX** switch is illuminated). The selected auxiliary group and function name are indicated in the left MODE/PATTERN window. The other two windows indicate the available selections for the auxiliary function.

### 3.2.4 MODE Switch (3)

When the **AUX** switch is not activated, the **MODE** switch selects the transmit and receive framing for the T-BERD 310. This should match the circuit being tested. If the framing format is unknown, select the AUTO mode. In AUTO mode, the T-BERD 310 automatically analyzes the received signal and configures itself accordingly.

Press the **MODE** switch to scroll the available operating modes in the MODE window. Allowing the selected mode to be displayed for more than one second configures the T-BERD 310 for that mode and restarts the test. Refer to Section 3.8 for more information on the operating modes. Press the **MODE** switch to select one of the following modes:

**M13** — DS3 M13 formatted transmit and receive mode.

**C-BIT** — DS3 C-bit parity formatted transmit and receive mode.

**MUXED M13** — Multiplexed DS3 M13 formatted transmit and receive mode. The DS3 signal contains embedded DS2 and DS1 framing.

**MUXED C-BIT** — Multiplexed DS3 C-bit parity formatted transmit and receive mode. The DS3 signal contains embedded DS2 and DS1 framing.

**DS1 INSERT** — The DS1 INSERT mode is available when the 310-3 DS1 Insert Option is installed (see Section 7).

**THRU** — The PRIMARY DS3 RECEIVE INPUT is retransmitted as the DS3 output.

**AUTO** — Automatically configured frame and pattern transmit and receive mode.

**UNFRAMED** — Unframed DS3 transmit and receive mode.

### 3.2.5 PATTERN Switch (4)

When the **AUX** switch is not activated, the **PATTERN** switch selects the mode-specific test pattern transmitted by the T-BERD 310. The selected test pattern is also used to obtain pattern synchronization on the receiver. Press the **PATTERN** switch to scroll the available test patterns in the PATTERN window. Table 3-1 lists the test patterns and their associated mode. Allowing the selected test pattern to be displayed for more than half a second configures the T-BERD 310 for that test pattern and restarts the test. Refer to Section 3.9 for more information on the test patterns.

**Table 3-1**
**Mode Specific Test Patterns**

| Operating Modes | Patterns |
|---|---|
| AUTO, UNFRAMED, M13, and C-BIT | 2^23-1, 2^20-1, 2^15-1, 1111, 1100 (IDLE)[1], 1010 (BLUE)[1], and USER1 |
| MUXED M13 and MUXED C-BIT | T1D4 QRSS, T1D4 3/24, T1D4 1:7, T1D4 1004Hz, T1D4 LPUP, T1D4 LPDN, T1ESF QRSS, T1ESF 3/24, T1ESF 1:7, T1ESF 1004Hz, T1ESF LPUP, T1ESF LPDN |
| DS1 INSERT[2] | EXTERNAL DS1 and INTERNAL DS1[3] |

[1] IDLE and BLUE appear only for framed signals.
[2] Requires the 310-3 DS1 Insert Option.
[3] Requires the 310-1 DS1/DS0 Analyzer Option.

### 3.2.6 TRANSMIT TIMING Switch (5)

The **TRANSMIT TIMING** switch selects the transmit clocking source for the T-BERD 310. The switch LEDs flash if the appropriate timing signal is not present. Press the **TRANSMIT TIMING** switch to select one of the following:

**INT** — The transmit timing source is generated by the internal crystal-controlled oscillator.

**RECOVD** — The transmit timing source is taken from the clock signal recovered from the received data. In the THRU and DS1 INSERT modes, the **TRANSMIT TIMING** switch automatically defaults to RECOVD regardless of the current setting. Recovered timing is used when the T-BERD 310 is monitoring a received signal.

**EXT** — The transmit timing source is taken from an external clock source received through the side-panel EXT CLOCK connector.

### 3.2.7 TEST Switch (6)

The **TEST** switch controls the duration of the test being performed. Changing the **TEST** switch position from TIMED to CONT does not cause a test restart, however changing from CONT to TIMED does cause a test restart. Press the **TEST** switch to select one of the following:

**CONT** — This position allows continuous testing. The TIME category ELAPSED TIME result indicates the elapsed time from the test restart. The results indicate accumulative counts since the test restart.

**TIMED** — This position allows timed testing. The timed test length is set through the TEST LENGTH auxiliary function (see Section 3.10.4). At the end of a timed test, the results and the state of the Status and Alarm LEDs are frozen. A *results* printout is generated at the end of the timed test when the **PRINT EVENT** switch is set to any position, except OFF (see Section 3.7.2).

### 3.2.8 AUX Switch (7)

The **AUX** switch has an internal LED that illuminates when the auxiliary functions are displayed. When the **AUX** switch is not illuminated, the mode, test pattern, and results are displayed. Auxiliary functions control settings that are less frequently used and do not have dedicated front-panel switches. The auxiliary functions are divided into six groups (seven when a SONET drop option is installed). Refer to Section 3.10 for more information on the auxiliary functions.

### 3.2.9 DS1 INSERT CHANNEL Switch (8)

The **DS1 INSERT CHANNEL** switch and channel window select the DS1 channel to be inserted into a DS3 signal. This switch is available in either the MUXED M13 or MUXED C-BIT mode. Either a D4 or ESF framed test pattern, 1004 Hz tone, or DS1 loop codes can be inserted into the selected channel. When the **DS1 INSERT CHANNEL** switch is pressed, the channel number flashes for three seconds before the new selection is affected. This allows time to change the selection without affecting a DS1 channel unintentionally. The **DS1 INSERT CHANNEL** switch selections include:

**1 to 28** — Inserts the test pattern on the selected DS1 channel. A framed All Ones pattern is inserted on the other 27 DS1 channels.

**ALL** — Inserts the selected test pattern on all 28 DS1 channels.

**— — — (none)** — Inserts a framed All Ones pattern on all 28 DS1 channels.

When the DS1 INSERT mode is selected, the **DS1 INSERT CHANNEL** switch functions differently (see Section 7).

### 3.2.10 DS1 DROP CHANNEL Switch (9)

The **DS1 DROP CHANNEL** switch selects the DS1 channel to be dropped. The selected DS1 channel number (1 to 28) is visible in the channel window above the switch.

When an AIS Indication is detected on the dropped DS1 channel, the decimal points appear in the **DS1 DROP CHANNEL** switch window.

The DS1 channel (1 to 28) can be dropped to the 310-1 DS1/DS0 Analyzer Option (see Section 6). If a SONET drop option is installed, a DS1 channel can be dropped from a SONET DS3 payload (see Section 8). If the 310-2 E1 Drop Option is installed, E1 channels (E1 to E21) can be dropped to the E1 DROP jack (see Section 9).

The DS1 channel can also be dropped from the PRIMARY DS3 RECEIVE INPUT jack to the side-panel DS1 DROP jack. The DS1 DROP jack allows an external DS1 test set to be connected to the T-BERD 310.

## 3.3 TEST CONNECTIONS

This section explains the available connections and switches used to access the circuit being tested. The primary DS3 signal connections are provided on the front panel as shown in Figure 3-3. This section describes the following front-panel connections and switches:

- PRIMARY DS3 RECEIVE INPUT jack (10)
- **PRIMARY DS3 RECEIVE INPUT** switch (10)
- PRIMARY DS3 TRANSMIT OUTPUT jack (11)
- **PRIMARY DS3 TRANSMIT OUTPUT** switch (11)

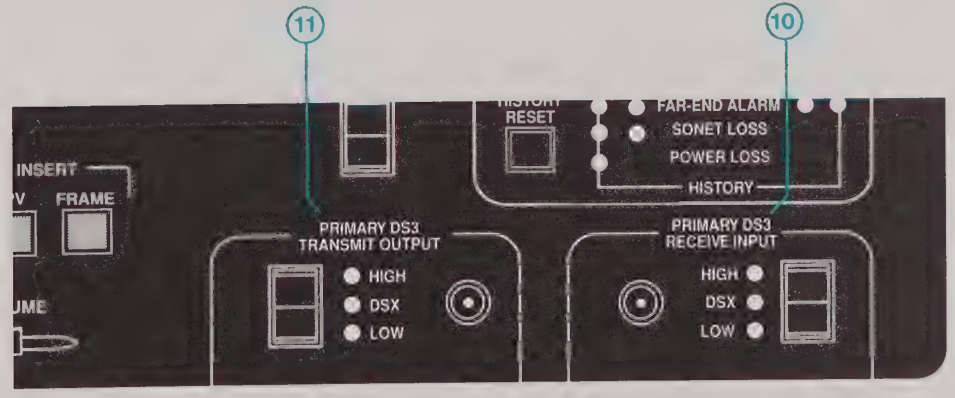



**Figure 3-3**
**Front-panel Connections**

The side panel contains standard and optional connections. This section describes the following standard side-panel connections:

- RS-232 interface connector
- MULTIPLE DS3 OUTPUT jacks
- DS1 DROP jack
- EXT CLOCK connector

The following optional connections are available and described in the appropriate sections.

- Side-panel IEEE-488 interface (see Sections 4 and 5)
- Front-panel 310-1 DS1/DS0 Analyzer Option port (see Section 6)
- Side-panel VF OUT jack (see Section 6)
- Side-panel DS1 TRANSMIT and DS1 RECEIVE jacks (see Section 6)
- Side-panel DATAPORT output connector (see Section 6)
- Side-panel DS1 INSERT INPUT jack (see Section 7)
- Side-panel SECONDARY DS3 RECEIVE input jack (see Section 7)
- Side-panel STS-1 RECEIVE and OC-1/3 RECEIVE input connections (see Section 8)
- Side-panel E1 DROP output jack (see Section 9)

The DS3 WECO 560A jacks can be replaced with WECO 358 jacks when the factory-installed 310-8 358 Connector Option is ordered.

### 3.3.1 Front-Panel Connections

The following T-BERD 310 front-panel connections and switches are used to receive and source a DS3 signal.

**PRIMARY DS3 RECEIVE INPUT jack** (10) — This WECO 560A jack is used to receive the DS3 signal from the circuit under test. The input signal equalization is controlled by the **PRIMARY DS3 RECEIVE INPUT** switch.

**PRIMARY DS3 RECEIVE INPUT switch** (10) — This switch sets the PRIMARY DS3 RECEIVE INPUT jack receiver for the desired DS3 signal level as follows:

***HIGH*** — The receiver accepts a nominal signal level of 0.9 Vp (0 feet of cable attenuation from a HIGH source). When presented with cable attenuation, the input signal level may range from +6 dB (-450 feet) of gain to -6 dB (450 feet) of loss from the nominal input level (0.9 Vp). When presented with resistive attenuation, the signal level may range from +6 dB of gain to -26 dB of loss from the nominal input level (0.9 Vp).

***DSX*** — The receiver accepts a nominal signal level of 0.5 Vp (450 feet of cable attenuation form a HIGH source). When presented with cable attenuation, the input signal level may range from + 6 dB (-450 feet) of gain to -6 dB (450 feet) of loss from the nominal level (0.5 Vp). When presented with resistive attenuation, the input signal level may range from +6 dB of gain to -26 dB of loss from the nominal level (0.5 Vp).

***LOW*** — The receiver accepts a nominal signal level of 0.2 Vp (900 feet of cable attenuation from a HIGH source). When presented with cable attenuation, the input signal level may range from +6 dB (-450 feet) of gain to -6 dB (450 feet) of loss from the nominal level (0.2 Vp). When presented with resistive attenuation, the input signal level may range from +6 dB of gain to -20 dB of loss from the nominal level (0.2 Vp).

**PRIMARY DS3 TRANSMIT OUTPUT switch** (11) — This switch sets the PRIMARY DS3 TRANSMIT OUTPUT jack and the side-panel MULTIPLE DS3 OUTPUT jacks transmitter level as follows:

***HIGH*** — This sets the receiver to accept an input signal level of up to 0.9 Vp. The acceptable signal level ranges from 6 dB above a nominal HIGH level or up to 26 dB of resistive loss from a nominal HIGH level.

***DSX*** — This sets the receiver to accept an input signal level of up to 0.5 Vp. The acceptable signal level ranges from 26 dB of resistive loss and 6 dB of cable loss (450 feet) from a nominal DSX level (450 feet from HIGH).

***LOW*** — This sets the receiver to accept an input signal level of up to 0.2 Vp. The acceptable signal level ranges from 20 dB of resistive loss or 6 dB of cable loss (450 feet) from a nominal 900 feet of cable attenuation (900 feet from HIGH).

### 3.3.2 Side-Panel Connections

Depending on the configuration of your T-BERD 310, the side panel provides a number of standard and optional connections. The standard side-panel connections (see Figure 3-4) include:

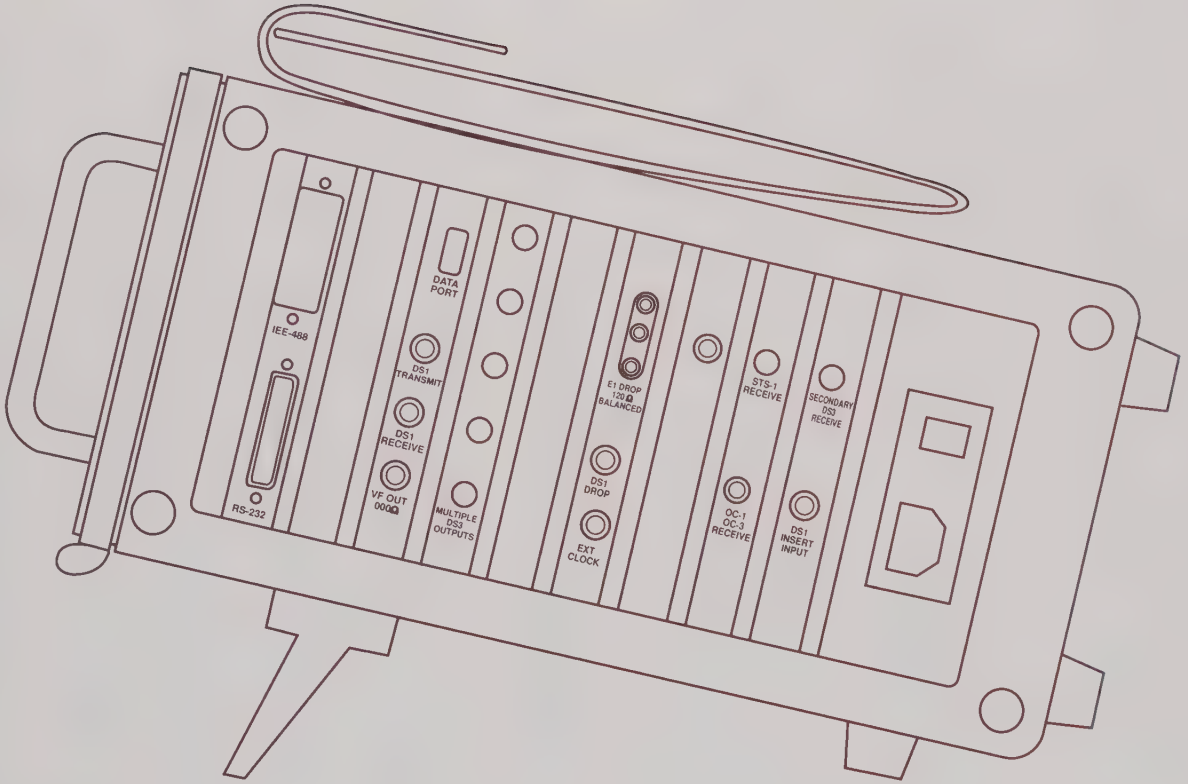



**Figure 3-4**
**T-BERD 310 Side Panel**

**RS-232 interface connector** — This RS-232-C, 25-pin D connector is configured as DCE. It is used to connect the T-BERD 310 to a serial printer, dumb terminal, computer, or other asynchronous communications device. The PRINT auxiliary group controls the baud rate, parity, and line terminator of the connector (see Section 3.10.5). The connector pin assignments are described in Section 11.

**MULTIPLE DS3 OUTPUT jacks** — These WECO 560A jacks provide five additional DS3 signal outputs and follow the PRIMARY DS3 TRANSMIT OUTPUT signal.

**DS1 DROP jack** — This WECO 310 jack enables the selected DS1 channel (**DS1 DROP CHANNEL** switch) to be dropped to an external DS1 test set. If a SONET drop option is installed, set the DS1 DROP OUT auxiliary function to DS3 to select the DS3 signal (see Section 8).

**EXT CLOCK connector** — This BNC connector enables an external DS3 clock source to be input to the T-BERD 310 as the DS3 transmit clock. The clock source is selected when the **TRANSMIT TIMING** switch is set to EXT (see Section 3.2.6).

## 3.4 SIGNAL VERIFICATION

This section describes the following indicators and results used to verify that the T-BERD 310 has properly acquired the received DS3 signal (see Figure 3-5).

- Status LEDs (12)
- Alarm LEDs (13)
- SUMMARY category

### 3.4.1 Status LEDs (12)

The green Status LEDs provide information about the current condition of the received primary and secondary (optional) DS3 signals. The Status LEDs are divided into two groups labeled PRIMARY and SECONDARY. The Primary Status LEDs (except for the SONET Present LED) refer to the signal received through the PRIMARY DS3 RECEIVE INPUT jack. The Primary Status LEDs also indicate the condition of the DS3 signal dropped from a SONET DS3 payload (see Section 8). The Secondary Status LEDs refer to the DS3 signal received through the SECONDARY DS3 RECEIVE jack when the 310-3 DS1 Insert Option is installed (see Section 7). The Status LEDs are described as follows:

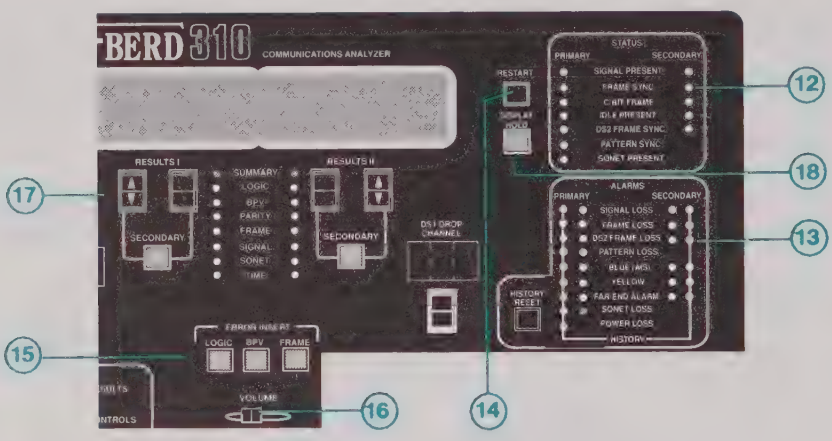



**Figure 3-5**
**Controls and Indicators for Testing**

**Signal Present** — Illuminates when the T-BERD 310 detects multiple DS3 pulses. If the received signal is lost, the LED goes out and the Signal Loss LED illuminates.

**Frame Sync** — Illuminates when the T-BERD 310 acquires M13 or C-bit frame synchronization. If the received framing format is lost, the LED goes out and the Frame Loss LED illuminates.

**C-Bit Frame** — Illuminates when the T-BERD 310 acquires C-bit frame synchronization.

**Idle Present** — Illuminates when the T-BERD 310 detects a DS3 Idle Signal.

**DS2 Frame Sync** — Illuminates when the T-BERD 310 synchronizes to the DS2 framing format corresponding to the dropped DS1 channel. The T-BERD 310 must be synchronized with the DS2 framing format before a DS1 signal can be inserted. If the received DS2 framing format is lost, the LED goes out and the DS2 Frame Loss LED illuminates.

**Pattern Sync** — Illuminates when the T-BERD 310 synchronizes to the test pattern displayed in the PATTERN window. If pattern synchronization is lost, the LED goes out and the Pattern Loss LED illuminates.

**SONET Present** — Illuminates only when the T-BERD 310 detects a valid SONET signal from either the side-panel STS-1 RECEIVE jack or OC-1/3 RECEIVE connector of a SONET drop option (see Section 8).

### 3.4.2 Alarm LEDs (13)

The red Alarm LEDs provide information about the current and historical alarm conditions related to the received primary and secondary (optional) DS3 signals. The Alarm LEDs are divided into two groups labeled PRIMARY and SECONDARY with two columns (current and history) each (see Figure 3-5). The Primary Alarm LEDs (except for the SONET Loss LED) refer to the signal received through the PRIMARY DS3 RECEIVE INPUT jack. The Primary Alarm LEDs also indicate the condition of the DS3 signal dropped from a SONET DS3 payload (see Section 8). The Secondary Alarm LEDs refer to the signal received through the SECONDARY DS3 RECEIVE jack when the 310-3 DS1 Insert Option is installed (see Section 7).

The Alarm LEDs (inside columns) illuminate when an alarm condition occurs and remain illuminated as long as the alarm exists. When the alarm condition is cleared, the Alarm LED goes out and the associated History LED (outside columns) illuminates. The History LEDs indicate past occurrences of the alarm and remain illuminated until either the **HISTORY RESET** switch is pressed or a test restart is initiated. The Primary Alarm LEDs are described as follows:

**Signal Loss** — Illuminates when DS3 pulses are no longer detected after initial signal detection. When the DS3 pulses are detected again, the LED goes out, and the associated History LED and the Signal Present LED illuminate (see Section 3.4.1).

**Frame Loss** — Illuminates when the T-BERD 310 loses DS3 frame synchronization. When DS3 framing is detected again, the LED goes out, and the associated History LED and the Frame Sync LED illuminate (see Section 3.4.1). The FRM LOSS THR auxiliary function sets the frame loss criteria (see Section 3.10.2).

**DS2 Frame Loss** — Illuminates when the T-BERD 310 loses frame synchronization to the DS2 signal for the corresponding dropped DS1 channel. When DS2 framing is detected again, the LED goes out, and the associated History LED and the DS2 Frame Sync LED illuminate (see Section 3.4.1).

**Pattern Loss** — Illuminates when the T-BERD 310 loses DS3 pattern synchronization. When the pattern is resynchronized again, the LED goes out, and the associated History LED and the Pattern Sync LED illuminate (see Section 3.4.1). The PAT LOSS THR auxiliary function sets the pattern loss criteria (see Section 3.10.2).

**Blue (AIS)** — Illuminates when the T-BERD 310 detects the Blue Signal (Alarm Indication Signal). When the Blue Signal is no longer detected, the LED goes out and the associated History LED illuminates. The BLU SIG CRI auxiliary function sets Blue Signal detection criteria (see Section 3.10.6).

**Yellow** — Illuminates when the T-BERD 310 detects the Yellow Alarm or Far-End Out-of-Frame (FEOOF) signal (X-bits set to zero). When the Yellow Alarm is no longer detected, the LED goes out and the associated History LED illuminates.

**Far-End Alarm** — Illuminates when the T-BERD 310 detects Far-End Alarm and Control (FEAC) messages in the C-bit parity framing format (third C-bit in the M1 subframe). When the far-end alarm is no longer detected, the LED goes out and the associated History LED illuminates. The alarm messages are reported in the SUMMARY category. Refer to Section 3.11.1 for a list of far-end alarm messages.

**SONET Loss** — Illuminates only when the T-BERD 310 no longer detects a valid SONET signal from either the side-panel STS-1 RECEIVE jack or OC-1/3 RECEIVE connector of a SONET drop option (see Section 8). When a valid SONET signal is detected again, the LED goes out, and the associated History LED and the SONET Present LED illuminate (see Section 3.4.1).

**Power Loss** — Illuminates when the T-BERD 310 regains power after power was lost.

**HISTORY RESET switch** — This switch clears all History LEDs on the T-BERD 310. This switch does not restart a test, nor does it affect any of the Alarm LEDs or accumulated results. It is not operable when the **DISPLAY HOLD** switch is activated. The **RESTART** switch also clears the History LEDs.

### 3.4.3 SUMMARY Category Messages

The SUMMARY category provides a convenient way to monitor specific results and measurements without having to search through the other categories. The SUMMARY category also provides a number of messages indicating whether the results are in or out of specification. The SUMMARY category is selected by pressing either the **RESULTS I Category** switch or the **RESULTS II Category** switch. When the category is selected, the appropriate yellow LED illuminates.

During initial acquisition of the received signal, the SUMMARY category should be displayed. The following messages can appear during signal acquisition:

**ALL RESULTS UNAVAILABLE** — This indicates that the T-BERD 310 has not detected the received signal.

**ALL RESULTS OK** — This indicates that the T-BERD 310 has detected and synchronized to the received signal and that no key results are non-zero or out-of-specification.

When an error is detected, the appropriate test result appears in the SUMMARY category window. Refer to Section 3.11.1 for more information on the results that appear in the SUMMARY category.

## 3.5 STARTING AND RUNNING THE TEST

This section explains the controls, indicators, and results used to run a test. The following front-panel controls and indicators are described in this section (see Figure 3-5):

- **RESTART** switch (14)
- **ERROR INSERT** switches (15)
- **VOLUME** switch (16)

### 3.5.1 RESTART Switch (14)

Pressing the **RESTART** switch halts the current test, clears all results, clears the Status and Alarm LEDs, resynchronizes the receiver to the received signal, and restarts the test.

**NOTE:** Pressing one of the following switches also causes a test restart of the T-BERD 310: **MODE, PATTERN, PRIMARY DS3 RECEIVE INPUT,** and **Power**. Modifying one of the following auxiliary functions causes a test restart: PAR ERR RT, FRM LOSS THR, ERROR THR, PAT LOS THR, TEST LENGTH, USER1, and PULSE MASK.

### 3.5.2 ERROR INSERT Switches (15)

After the T-BERD 310 has synchronized to the received signal, in-service monitoring and analysis can be performed without additional setup requirements. However, if the circuit being tested is configured for an out-of-service loopback or end-to-end test, you may need to verify that the transmitted signal is being received. One way to verify this is to insert an error into the transmitted signal and verify that the error is received. The T-BERD 310 has the ability to insert errors (logic, BPV, and frame) simply by pressing one of three **ERROR INSERT** switches (see Figure 3-5).

The three **ERROR INSERT** switches (**LOGIC**, **BPV**, and **FRAME**) insert logic errors, BPVs, and frame errors into the data stream individually or simultaneously. Error insertion

affects the transmitted signal at the PRIMARY DS3 TRANSMIT OUTPUT and MULTIPLE DS3 OUTPUT jacks. The **ERROR INSERT** switches perform the following functions:

**LOGIC ERROR INSERT switch** — Press this switch to insert single, burst, or continuous logic errors into the transmitted DS3 data and overhead bits. When the **LOGIC** switch is pressed, an internal switch LED illuminates indicating errors are being inserted with a duration selected as follows:

***Single logic error inserted*** — A single logic error is inserted when the **LOGIC** switch is pressed for less than one second and the LOG/BPV BUR auxiliary function is set to SINGLE. The switch LED flashes once indicating a single logic error is inserted.

***Burst of logic errors inserted*** — A burst of logic errors is inserted when the **LOGIC** switch is pressed for less than one second and the LOG/BPV BUR auxiliary function is set for a duration from 25 ms to five seconds. The LOG/BPV RT auxiliary function sets the error rate from 1E-2 to 1E-9. The switch LED flashes for one second or for the duration of the burst, whichever is greater.

***Continuous logic errors inserted*** — Continuous logic errors are inserted when the **LOGIC** switch is pressed for more than one second. The switch LED flashes once and then illuminates continuously. Pressing the illuminated switch again turns the error insertion off and extinguishes the LED. The LOG/BPV RT auxiliary function sets the error rate from 1E-2 to 1E-9.

**BPV ERROR INSERT switch** — Press this switch to insert single, burst, or continuous BPVs into the transmitted DS3 signal. When the **BPV** switch is pressed, an internal switch LED illuminates indicating violations are being inserted with a duration selected as follows:

***Single BPV inserted*** — A single BPV is inserted when the **BPV** switch is pressed for less than one second and the LOG/BPV BUR auxiliary function is set to SINGLE. The switch LED flashes once indicating a single BPV is inserted.

***Burst of BPVs inserted*** — A burst of BPVs is inserted when the **BPV** switch is pressed for less than one second and the LOG/BPV BUR auxiliary function is set for a duration from 25 ms to five seconds. The LOG/BPV RT auxiliary function sets the violation rate from 1E-2 to 1E-9. The switch LED flashes for one second or for the duration of the burst, whichever is greater.

***Continuous BPVs inserted*** — Continuous BPVs are inserted when the **BPV** switch is pressed for more than one second. The switch LED flashes once and then illuminates continuously. Pressing the illuminated switch again turns the error insertion off and extinguishes the LED. The LOG/BPV RT auxiliary function sets the error rate from 1E-2 to 1E-9.

**FRAME ERROR INSERT switch** — Press this switch to insert single, multiple, or continuous consecutive M-frame errors into the transmitted DS3 framing bits. The **FRAME** switch is disabled in the UNFRAMED, THRU, AUTO (with "live" pattern displayed), and DS1 INSERT (310-3 DS1 Insert Option installed) modes. When the **FRAME** switch is pressed, an internal switch LED illuminates indicating errors are being inserted with a duration selected as follows:

***Single frame error inserted*** — A single frame error is inserted when the **FRAME** switch is pressed for less than one second and the FRAME ERROR auxiliary function is set to 1/M-FRAME. The switch LED flashes once indicating a single frame error is inserted.

***Multiple frame errors inserted*** — Multiple consecutive frame errors are inserted when the **FRAME** switch is pressed for less than one second and the FRAME ERROR auxiliary function is set to 2/M-FRAME. The switch LED flashes for one second.

***Continuous consecutive frame errors inserted*** — Frame errors are inserted into every M-frame when the **FRAME** switch is pressed for more than one second. The switch LED flashes once and then illuminates continuously. Pressing the illuminated switch again turns the error insertion off and extinguishes the LED. The FRAME ERROR auxiliary function sets the number of frame errors for 1/M-FRAME or 2/M-FRAME.

The error insertion duration and rate selections are controlled through the following ERR INSERT auxiliary group (see Section 3.10.1):

**LOG/BPV BUR** — This auxiliary function sets the logic and BPV error burst duration (single and bursts from 25 ms to five seconds).

**LOG/BPV RT** — This auxiliary function sets the continuous or burst error rate for logic error and BPV insertion (from 1E-2 to 1E-9).

**FRAME ERROR** — This auxiliary function sets the consecutive frame error insertion rate (one and two consecutive frame errors per M-frame).

### 3.5.3 VOLUME Switch (16)

The **VOLUME** control switch (see Figure 3-5) controls the output of the built-in speaker. The T-BERD 310 beeps whenever conditions set by the BEEP CRI auxiliary function are met (see Section 3.10.6). If the 310-1 DS1/DS0 Analyzer Option is installed, the **VOLUME** switch also controls the DS0 channel volume of the speaker.

## 3.6 COLLECTING TEST RESULTS

This section describes the available test result categories and and the following controls to collect the test results.

- **RESULTS** switches (17)
- **DISPLAY HOLD** switch (18)

### 3.6.1 Categorized Test Results

During a test, the available results and signal measurements are continuously updated. The results are divided into seven categories (eight when a SONET drop option is installed). The first and most commonly used category is the SUMMARY category. During the initial test setup procedure, the SUMMARY category displays key non-zero or out-of-specification results. Refer to Section 3.11 for more information on the test results. The available categories include:

**SUMMARY category —** Lists key results that are non-zero or out-of-specification.

**LOGIC category —** Lists pattern bit error related results.

**BPV category —** Lists bipolar violation related results.

**PARITY category —** Lists P-bit, C-bit, FEBE, and parity error related results.

**FRAME category —** Lists DS3 and DS2 frame error related results.

**SIGNAL category —** Lists signal (frequency, level, and pulse shape) related results.

**SONET category —** Lists SONET overhead error, frame word error, and frequency related results (see Section 8).

**TIME category —** Lists time related results.

When the mode and pattern are displayed, two results are displayed simultaneously in the RESULTS I and RESULTS II windows. The available categories and results are selected with the following switches.

**RESULTS I Category switch or RESULTS II Category switch** — Selects the category from the list of categories next to the switch. The labeled LEDs illuminate as the category is selected. Categories are skipped when they do not apply to a particular operating mode.

**RESULTS I Results switch or RESULTS II Results switch** — Selects the individual results from the indicated category.

**RESULTS I SECONDARY switch or RESULTS II SECONDARY switch** — Selects the results from the secondary DS3 signal when the 310-3 DS1 Insert Option is installed. The SUMMARY, BPV, PARITY, FRAME, and SIGNAL categories are the only categories available when the **SECONDARY** switch is pressed. An internal switch LED illuminates when the secondary DS3 results are displayed. Use the **RESULTS** switches to select the secondary DS3 results.

### 3.6.2 DISPLAY HOLD Switch (18)

Pressing the **DISPLAY HOLD** switch (internal switch LED illuminated) temporarily freezes the results and Status and Alarm LEDs (see Figure 3-5). During the display hold, all results can be examined by using the **RESULTS** switches. The results also continue to accumulate in the background. When the **DISPLAY HOLD** switch is released, the results and LEDs are updated.

## 3.7 PRINTING THE TEST SETUP AND RESULTS

This section explains the controls used to store and print results and configurations (see Figure 3-6). The *results* printout can be generated manually (**PRINT RESULTS** switch) and automatically (**PRINT EVENT** switch). The *controls* printouts are generated manually (**PRINT CONTROLS** switch). All printouts contain a title and are date- and time-stamped. Specific information on the printer operation can be found in Section 4. The following controls are described in this section:

- **PRINT** switch (19)
- **PRINT EVENT** switch (19)

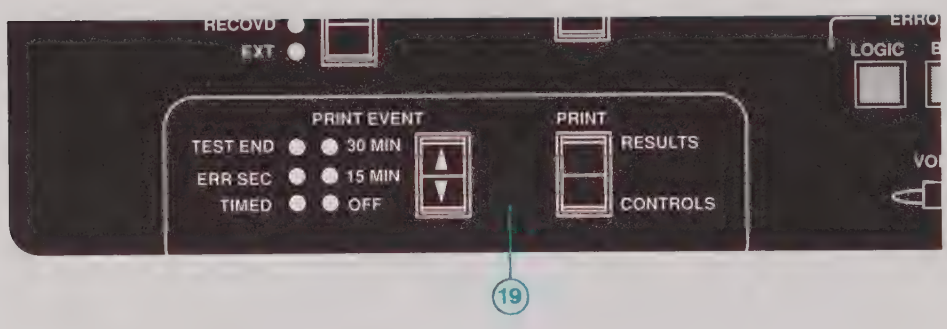



Figure 3-6
Printer Control Switches

### 3.7.1 PRINT Switch (19)

The **PRINT** switch generates either a *results* or a *controls* printout. The switch positions are described as follows:

**RESULTS** — Pressing the RESULTS position generates a date- and time-stamped printout of the current T-BERD 310 results. Results become available only after the T-BERD 310 has received a valid signal. The T-BERD 310 results can be customized through the CUSTOM auxiliary function (see Section 3.10.5).

**CONTROLS** — Pressing the CONTROLS position generates a date- and time-stamped printout of the current T-BERD 310 front-panel and auxiliary function configuration. This printout records how the T-BERD 310 is configured for testing.

### 3.7.2 PRINT EVENT Switch (19)

The **PRINT EVENT** switch selects the event that automatically initiates a *results* printout. Press this switch to step through the print events and illuminate the corresponding LED. All print event selections, except for OFF, allow status and alarm messages to be printed. A list of status messages is found in Appendix B. The **PRINT EVENT** switch positions are described as follows:

**OFF** — The print event functions are disabled and no status or alarm messages are printed. A manual *results* printout can be generated using the **PRINT** switch.

**15 MIN** — A *results* printout is generated every 15 minutes.

**30 MIN** — A *results* printout is generated every 30 minutes.

**TEST END** — A *results* printout is generated when the test length has expired. The results and Status and Alarm LEDs are frozen at this time. The test length is set using the TEST LENGTH auxiliary function (see Section 3.10.4).

**ERR SEC** — A *results* printout is generated for every occurrence of an errored second.

**TIMED** — A *results* printout is generated at a specified interval. The test interval is set using the INTERVAL auxiliary function. The results are printed in two modes, continuous and delta. The MODE auxiliary function sets the print mode (see Section 3.10.5).

## 3.8 OPERATING MODES

The **MODE** switch selects the transmit and receive framing format configuration for the T-BERD 310. Press the **MODE** switch to select one of the following modes:

**M13** — Configures the T-BERD 310 to test (non-channelized) DS3 M13 formatted signals.

**C-BIT** — Configures the T-BERD 310 to test (non-channelized) DS3 C-bit parity formatted signals.

**MUXED M13** — Configures the T-BERD 310 to generate a multiplexed (channelized) DS3 M13 signal. The multiplexed DS3 signal contains embedded DS2 and DS1 framing. DS1 level test patterns are selectable with the **PATTERN** switch. The test pattern is inserted into the desired DS1 channels using the **DS1 INSERT CHANNEL** switch.

**MUXED C-BIT** — Configures the T-BERD 310 to generate a multiplexed (channelized) DS3 C-bit parity signal. The multiplexed DS3 signal contains embedded DS2 and DS1 framing. DS1 level test patterns are selectable with the **PATTERN** switch. The test pattern is inserted into the desired DS1 channels using the **DS1 INSERT CHANNEL** switch.

**DS1 INSERT** — Appears when the 310-3 DS1 Insert Option is installed (see Section 7).

**THRU** — Configures the receiver to scan and synchronize to the input signal framing and pattern information. The transmitter retransmits the received framing and pattern as it is received, including any errors (not BPVs). In THRU mode, the **TRANSMIT TIMING** switch defaults to RECOVD timing.

If the received signal is recognized as a test pattern:

- The test pattern name appears in lowercase characters in the PATTERN window.
- The transmitter retransmits the received signal, including errors (not BPVs).
- Logic errors and BPVs can be inserted with the ERROR INSERT switches.
- Full logic, BPV, parity, frame, and signal error analysis is performed on the received signal.
- The appropriate Status LEDs illuminate.

If the received signal is *not* recognized as a test pattern, but live data:

- The word "live" appears in the PATTERN window.
- The transmitter retransmits the received signal, including errors (not BPVs).
- Logic errors and BPVs can be inserted with the **ERROR INSERT** switches.
- Full BPV, parity, frame, and signal error analysis is performed on the received signal. The LOGIC category is not applicable during live data analysis.
- The appropriate Status LEDs illuminate.

**AUTO** — Configures the receiver to scan and synchronize to the input signal framing and pattern information. After achieving synchronization, the transmitter regenerates the framing and test pattern without errors. If "live" data is declared, the **TRANSMIT TIMING** switch defaults to RECOVD. If signal loss occurs and then returns, press the **RESTART** switch to restart AUTO mode.

If the received signal is recognized as a test pattern:

- The test pattern name appears in lowercase characters in the PATTERN window.
- The transmitter is configured to generate the recognized framing format and test pattern.
- Logic errors and BPVs can be inserted with the **ERROR INSERT** switches.
- Full logic, BPV, parity, frame, and signal error analysis is performed on the received signal.

- The appropriate Status LEDs illuminate.

If the received signal is *not* recognized as a test pattern, but live data:

- The word "live" appears in the PATTERN window.
- The transmitter retransmits the received signal, including errors (not BPVs).
- Logic errors and BPVs can be inserted with the **ERROR INSERT** switches.
- Full BPV, parity, frame, and signal error analysis is performed on the received signal. The LOGIC category is not applicable during live data analysis.
- The appropriate Status LEDs illuminate.

**UNFRAMED —** Configures the T-BERD 310 to test unframed DS3 circuits.

## 3.9 TEST PATTERNS

The **PATTERN** switch selects the mode-specific test patterns. When the operating mode is changed, the displayed test pattern may not be valid for the new mode. In this case, the last valid test pattern for the selected mode is displayed. The mode-specific test patterns are divided into three groups: non-channelized, channelized, and DS1 Insert. The patterns are described as follows:

**Non-channelized test patterns —** These patterns are non-channelized, i.e., they do not contain DS2 or DS1 framing. Unless otherwise indicated, the following DS3 test patterns can be transmitted in the M13, C-BIT, UNFRAMED, and AUTO modes.

***2^23-1 —*** An 8,388,607-bit pseudorandom pattern which generates a maximum of 22 sequential zeros and 23 sequential ones. This pattern conforms to CCITT Recommendation O.151.

***2^20-1 —*** A 1,048,575-bit pseudorandom pattern which generates a maximum of 19 sequential zeros and 20 sequential ones. This pattern conforms to CCITT Recommendation O.151.

***2^15-1 —*** A 32,767-bit pseudorandom pattern which generates a maximum of 14 sequential zeros and 15 sequential ones. This pattern conforms to CCITT Recommendation O.151.

***1111*** — An all marks (1) pattern and is available in all modes except MUXED M13 and MUXED C-BIT.

***1100 (IDLE)*** — A repeating two marks (1) and two spaces (0) pattern which equates to sending the DS3 Idle Signal. It is only available in the M13 and C-BIT modes.

***1100*** — An unframed repeating two marks (1) and two spaces (0) pattern which is only available in the UNFRAMED mode.

***1010 (BLUE)*** — An alternating marks (1) and spaces (0) pattern which equates to sending the DS3 Blue Signal. It is only available in the M13 and C-BIT modes.

***1010*** — An unframed alternating marks (1) and spaces (0) pattern which is only available in the UNFRAMED mode.

***USER1*** — A 3- to 24-bit user-programmable test pattern. This allows the T-BERD 310 to transmit specific patterns to test circuit sensitivity. The pattern is entered in binary form through the USER1 auxiliary function.

**Channelized test patterns** — These patterns are channelized, i.e., they contain embedded DS2 and DS1 framing. The following DS1 test patterns are available when either the MUXED M13 or MUXED C-BIT mode is selected. The test patterns are formatted with either D4 or ESF framing.

***T1D4 QRSS*** — A modified $2^{20}$-1 pseudorandom pattern which allows a maximum of 14 sequential zeros and 20 sequential ones. The T1D4 QRSS pattern simulates live data for T1 applications.

***T1D4 3/24*** — A fixed test pattern of F0100 0100 0000 0000 0000 0100.... The pattern is aligned with the D4 F-bits as indicated.

***T1D4 1:7*** — A fixed test pattern of F01000000.... The pattern is aligned with the D4 F-bits as indicated, to prevent false Yellow Alarms.

***T1D4 1004Hz*** — A 1004 Hz tone which is transmitted over the selected DS1 channel. The tone is phase shifted between adjacent DS0 channels to prevent Yellow Alarms.

***T1D4 LPUP*** — A loop-up code selected with the DS1 LP CODE auxiliary function.

***T1D4 LPDN*** — A loop-down code selected with the DS1 LP CODE auxiliary function.

***T1ESF QRSS*** — A modified $2^{20}$-1 pseudorandom pattern which allows a maximum of 14 sequential zeros and 20 sequential ones. The T1ESF QRSS pattern simulates live data for T1 applications.

***T1ESF 3/24*** — A fixed test pattern of F0100 0100 0000 0000 0000 0100.... The pattern is aligned with the ESF F-bits as indicated.

***T1ESF 1:7*** — A fixed test pattern of F01000000....

***T1ESF 1004Hz*** — A 1004 Hz tone which is transmitted over the selected DS1 channel.

***T1ESF LPUP*** — A loop-up code selected with the DS1 LP CODE auxiliary function (see Section 3.10.3).

***T1ESF LPDN*** — A loop-down code selected with the DS1 LP CODE auxiliary function (see Section 3.10.3).

**DS1 INSERT mode** — This mode is only available when the 310-3 DS1 Insert Option is installed (see Section 7).

***EXTERNAL DS1*** — This selects the DS1 signal input from the side-panel DS1 INSERT INPUT jack.

***INTERNAL DS1*** — This selects the DS1 signal generated by the 310-1 DS1/DS0 Analyzer Option (see Section 6).

## 3.10 AUXILIARY FUNCTIONS

Auxiliary functions allow access to parameters that are not frequently used and do not have dedicated switches. Press the **AUX** switch to access the auxiliary functions. The auxiliary functions appear in all three display windows. Table 3-2 lists the auxiliary functions by group. The **MODE, PATTERN, RESULTS I,** and **RESULTS II** switches are used to manipulate the displayed auxiliary function. The switches perform the following functions:

**MODE switch** — Press this switch to scroll through the auxiliary groups.

**PATTERN switch** — Press this switch to scroll through the auxiliary functions of the selected auxiliary group.

**RESULTS I and RESULTS II switches** — These switches are used in combination to change or enter information into the selected auxiliary function.

**Table 3-2**
**T-BERD 310 Auxiliary Functions**

| Group (MODE Switch) | Function (PATTERN Switch) | Description |
|---|---|---|
| ERR INSERT | | DS3 Error Insertion Group |
| | LOG/BPV RT | Logic and BPV Error Insertion Rate |
| | FRAME ERROR | M-Frame Error Insertion Rate |
| | LOG/BPV BUR | Logic and BPV Error Insertion Burst Duration |
| ERR RECEIVE | | DS3 Received Signal Error Group |
| | PAR ERR RT | Parity Category Error Rate Calculation |
| | FRM LOSS THR | Frame Synchronization Loss Threshold |
| | ERROR THR | Logic, BPV, and Frame Error Rate Threshold |
| | PAT LOSS THR | Pattern Loss Threshold |
| MUXED TX | | Multiplexed Loop Code Group |
| | DS1 LP CODE | DS1 Loop Code Selection |
| | PGM LPUP | Programmable Loop-Up Code |
| | PGM LPDN | Programmable Loop-Down Code |
| TIME | | Time and Date Group |
| | SET TIME | Set Time |
| | SET DATE | Set Date |
| | TEST LENGTH | Set Test Length |
| PRINT | | Printer/Remote Control Interface Group |
| | INTERVAL | Timed Printout Interval |
| | MODE | Printout Mode |
| | FORMAT | Printout Format |
| | CUSTOM | Customized Printout Contents |
| | GRAPH | Print Graph |
| | BAUD RATE | RS-232 Interface Baud Rate |
| | PARITY | RS-232 Interface Parity |
| | TERMINATOR | Printout Line Terminator |
| | WIDTH | Printout Line Width |
| | PORT | Printer/Remote Control Interface Port Selection (Requires 310-6 IEEE-488 Option) |

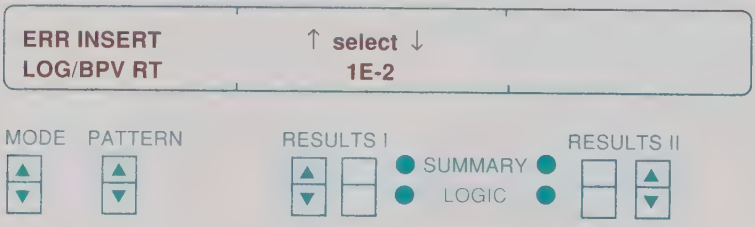
Table 3-2
T-BERD 310 Auxiliary Functions (Continued)

| Group (MODE Switch) | Function (PATTERN Switch) | Description |
|---|---|---|
| MISC | | Miscellaneous Group |
| | USER1 | User-Programmable Test Pattern |
| | TX X-BIT | X-Bit Transmission |
| | BLU SIG CRI | Blue Signal Detection Criteria |
| | DS1 LINECODE | DS1 Drop Output Line Coding |
| | BEEP CRI | Beep Criteria |
| | PULSE MASK | Pulse Shape Mask |
| SONET | | SONET Group (Requires 310-4/A SONET Drop Option) |
| | SONET INPUT | SONET Input Signal Source (Requires 310-4A SONET Drop Option) |
| | DS1 DROP OUT | DS1 Dropout Source |
| | SONET DS1 CH | SONET DS1 Channel Select |
| | STS RX LEVEL | STS Receive Level |
| JITTER | | DS3 Jitter Group (Requires 310-5 DS3 Jitter Option) |
| | JIT FILTER | Jitter Bandpass Filter Select |
| | JIT SCALE | Jitter Amplitude Scale Select |

### 3.10.1 ERR INSERT — DS3 Error Insertion Group

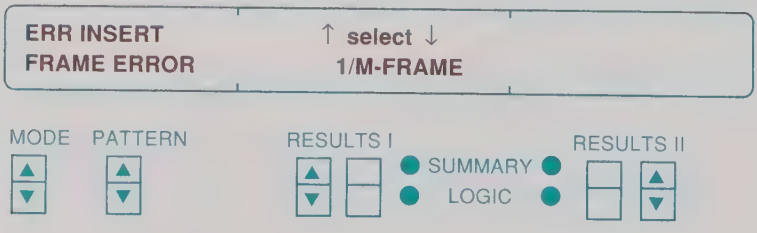
The ERR INSERT auxiliary group controls the DS3 logic, BPV, and frame error insertion capabilities of the **ERROR INSERT** switches (see Section 3.5.2). The ERR INSERT auxiliary group is described as follows:

#### LOG/BPV RT — Logic and BPV Error Insertion Rate



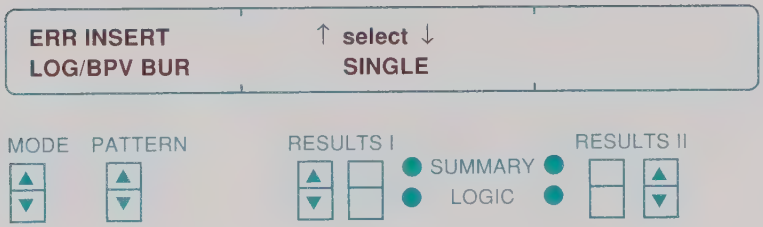

The LOG/BPV RT auxiliary function sets the logic error and BPV insertion rate when a burst of errors (see the LOG/BPV BUR auxiliary function) or continuous errors are inserted into the transmitted bit stream. Errors and violations are inserted with the **LOGIC** and **BPV ERROR INSERT** switches. Press the **RESULTS I Results** switch to select the error rate from 1E-2 to 1E-9.

#### FRAME ERROR — M-Frame Error Insertion Rate




The FRAME ERROR auxiliary function selects the number of consecutive frame errors (per M-frame) that are inserted into the transmitted framing pattern. The frame errors are inserted with the **FRAME ERROR INSERT** switch. Press the **RESULTS I Results** switch to select one or two frame errors per M-frame.

### LOG/BPV BUR — Logic and BPV Error Insertion Burst Duration




The LOG/BPV BUR auxiliary function sets the duration for logic error or BPV bursts when the **LOGIC** or **BPV ERROR INSERT** switch is pressed for less than one second. The LOG/BPV RT auxiliary function sets the error rate for the burst. Press the **RESULTS I Results** switch to select one of the following burst durations:

**SINGLE** — Inserts either a single logic error or BPV when the appropriate switch is pressed for less than one second.

**25 ms to 1.0 second burst (in 25 ms steps)** — Inserts a logic error or BPV burst from 25 ms to one second when the appropriate switch is pressed for less than one second.

**1.0 to 5.0 seconds burst (in 100 ms steps)** — Inserts a logic error or BPV burst from one to five seconds when the appropriate switch is pressed for less than one second.

## 3.10.2 ERR RECEIVE — DS3 Received Signal Error Group

The ERR RECEIVE auxiliary group controls the parity error rate calculation method, logic, BPV, and frame error rate threshold for the appropriate categories, and frame synchronization loss threshold. The ERR RECEIVE auxiliary group is described as follows:

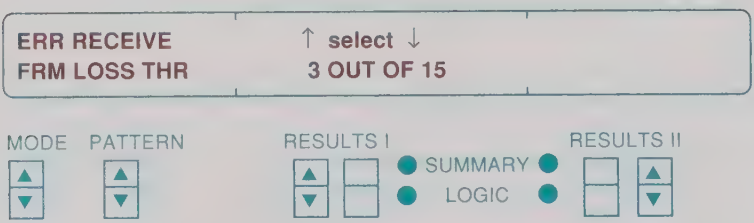
### PAR ERR RT — Parity Category Error Rate Calculation

The PAR ERR RT auxiliary function selects the parity error rate calculation method. Changing the selection causes a test restart. Press the **RESULTS I Results** switch to select the desired calculation method:

**BLOCK ERROR —** The block error method is calculated as the ratio of the total number of parity errors to the total number of M-frames received.

**BIT ERROR —** The bit parity error rate is calculated as the ratio of the total number of parity errors to the total number of bits over which the parity was calculated (number of received M-frames multiplied by 4704). The bit parity error rate gives the best indication of the actual bit error rate.

### FRM LOSS THR — Frame Synchronization Loss Threshold

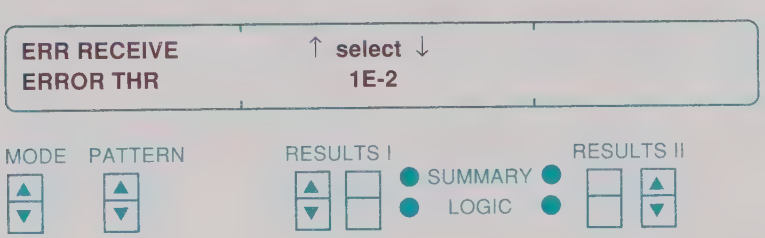



The FRM LOSS THR auxiliary function determines when the T-BERD 310 loses frame synchronization. Changing the selection causes a test restart. Press the **RESULTS I Results** switch to select the desired threshold:

**3 OUT OF 15 —** Frame synchronization is lost when three frame errors are counted in 15 received frame bits.

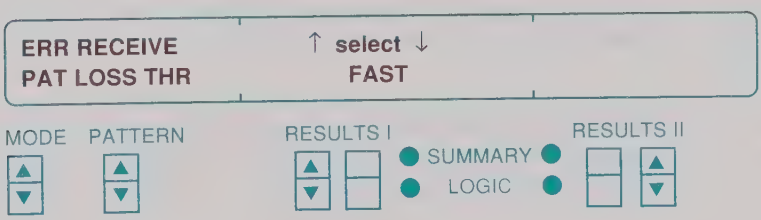
**6 OUT OF 15 —** Frame synchronization is lost when six frame errors are counted in 15 received frame bits.

### ERROR THR — Logic, BPV, and Frame Errored Second Threshold




The ERROR THR auxiliary function selects the errored second thresholds for the BIT THR ES, FRM THR ES, and BPV THR ES results. Changing the selection causes a test restart. Press the **RESULTS I Results** switch to select the desired error rate threshold from 1E-2 to 1E-8.

### PAT LOSS THR — Pattern Loss Threshold




The PAT LOSS THR auxiliary function selects the criteria that determines when the T-BERD 310 loses pattern synchronization. Changing the selection causes a test restart. Press the **RESULTS I Results** switch to select the desired threshold criteria:

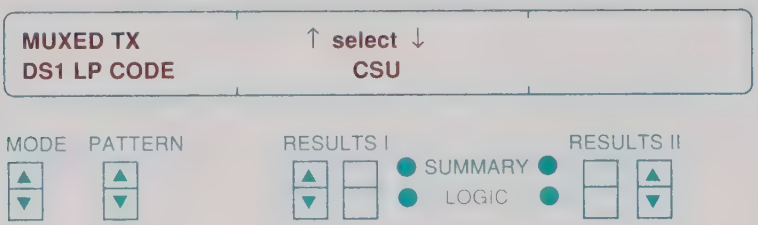
**FAST** — Pattern synchronization is lost when 1024 or more bit errors are counted in 32,767 bits received.

**SLOW** — Pattern synchronization is lost when 250,000 or more bit errors are counted in 1,000,000 bits received.

### 3.10.3 MUXED TX — Multiplexed Loop Code Group

The MUXED TX auxiliary group controls the multiplexed DS3 output DS1 loop codes. The MUXED TX auxiliary group is described as follows:

#### DS1 LP CODE — DS1 Loop Code Select




The DS1 LP CODE auxiliary function selects the DS1 loop code for the MUXED M13 and MUXED C-BIT modes. The appropriate loop code is transmitted when the T1D4 LPDN, T1D4 LPUP, T1ESF LPDN, or T1ESF LPUP pattern is selected. The loop code is inserted with the **DS1 INSERT CHANNEL** switch. Press the **RESULTS I Results** switch to select the desired loop code from the following:

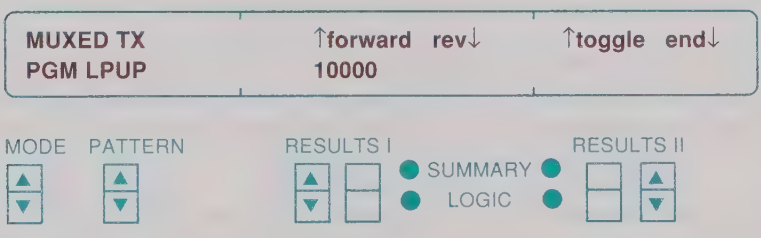
**CSU** — The Customer Service Unit loop codes allow the T-BERD 310 to establish a DS1 loopback with a compatible CSU. The transmitted loop-up code is 10000 and the loop-down code is 100.

**FACILITY 1** — The 4-bit facility or network (or smart jack) loop codes allow the T-BERD 310 to establish a loopback with a compatible facility interface. The transmitted loop-up code is 1100 and the loop-down code is 1110.

**FACILITY 2** — The 5-bit facility or network (or smart jack) loop codes allow the T-BERD 310 to establish a loopback with a compatible facility interface. The transmitted loop-up code is 11000 and the loop-down code is 11100.

**PROGRAMMABLE** — The 3- to 8-bit programmable loop codes allow the T-BERD 310 to establish a loopback with any nonstandard device. The loop codes are programmed through the PGM LPUP and PGM LPDN auxiliary functions.

## PGM LPUP — Programmable Loop-Up Code

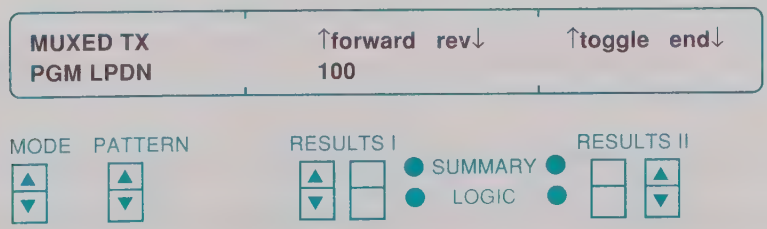



The PGM LPUP auxiliary function programs a 3- to 8-bit user-defined loop-up code. This allows the T-BERD 310 to transmit nonstandard loop codes. The programmed loop-up code is transmitted when the MUXED M13 or MUXED C-BIT mode and the T1D4 LPUP or T1ESF LPUP pattern are selected. The DS1 LP CODE auxiliary function must be set to PROGRAMMABLE. The loop code is transmitted in left-to-right order. The PGM LPUP auxiliary function is controlled by the following switches:

**RESULTS I Results switch —** Press the up arrow to move the cursor forward from left to right. Moving the cursor forward past the last displayed bit automatically inserts a "0" in each new position up to eight bits. Press the down arrow to move the cursor in reverse from right to left.

**RESULTS II Results switch —** Press the up arrow to toggle the highlighted bit from 0 to 1. Press the down arrow to save and end the displayed bit pattern up to the position of the cursor. Any bits to the right of the cursor are deleted and the cursor returns to the left most bit position. The loop code is only saved when *end* is selected.

## PGM LPDN — Programmable Loop-Down Code




The PGM LPDN auxiliary function programs a 3- to 8-bit user-defined loop-down code. This allows the T-BERD 310 to transmit nonstandard loop codes. The programmed loop-down code is transmitted when the MUXED M13 or MUXED C-BIT mode and the T1D4

LPDN or T1ESF LPDN pattern are selected. The DS1 LP CODE auxiliary function must be set to PROGRAMMABLE. The loop code is transmitted in left-to-right order. The PGM LPDN auxiliary function is controlled by the following switches:

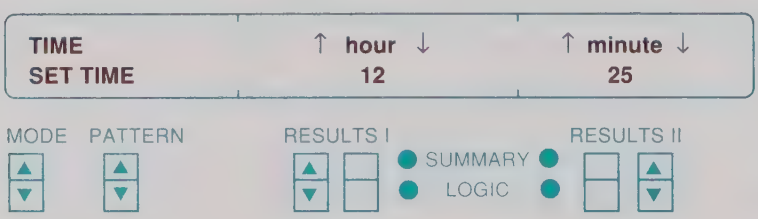
**RESULTS I Results switch** — Press the up arrow to move the cursor forward from left to right. Moving the cursor forward past the last displayed bit automatically inserts a "0" in each new position up to eight bits. Press the down arrow to move the cursor in reverse from right to left.

**RESULTS II Results switch** — Press the up arrow to toggle the highlighted bit from 0 to 1. Press the down arrow to save and end the displayed bit pattern up to the position of the cursor. Any bits to the right of the cursor are deleted and the cursor returns to the left most bit position. The loop code is only saved when *end* is selected.

### 3.10.4 TIME — Time and Date Group

The TIME auxiliary group controls the date and time for the battery-backed clock, and the test length for timed tests. The TIME auxiliary group is described as follows:

#### SET TIME — Set Time




The SET TIME auxiliary function sets the time for the battery-backed clock. The current time of day is displayed in the TIME category and printed on all printouts. Press the **RESULTS** switches to select the desired time:

**RESULTS I Results switch** — Press this switch to set the hour in a 24-hour clock format.

**RESULTS II Results switch** — Press this switch to set the minutes from 00 to 59 minutes.

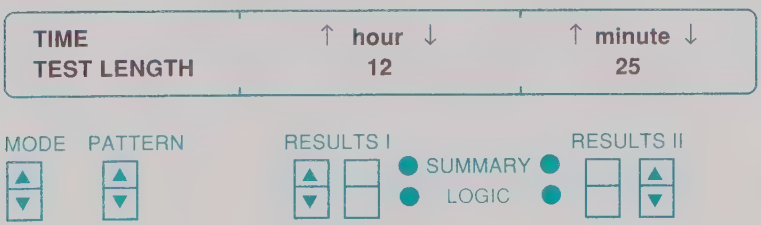
## SET DATE — Set Date

The SET DATE auxiliary function sets the month and the day. The current month and day are displayed in the TIME category and printed on all printouts. Press the **RESULTS** switches to select the desired date:

**RESULTS I Results switch —** Press this switch to set the month from JAN to DEC.

**RESULTS II Results switch —** Press this switch to set the day from 1 to 31.

## TEST LENGTH — Set Test Length




The TEST LENGTH auxiliary function sets the timed test length when the **TEST** switch is set to TIMED. If the test length is changed, a test restart occurs when the auxiliary function is exited. The timed test range is from 00:01 to 999:59. Press the **RESULTS** switches to select the desired test length:

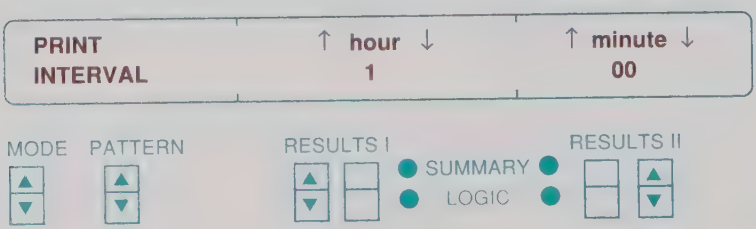
**RESULTS I Results switch —** Press this switch to set the hour from 0 to 999 hours.

**RESULTS II Results switch —** Press this switch to set the minutes from 00 to 59 minutes.

### 3.10.5 PRINT — Printer/Remote Control Interface Group

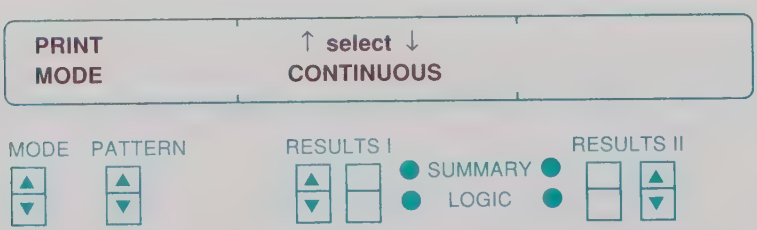
The PRINT auxiliary group configures the RS-232-C and IEEE-488 (optional) interface operation, and the printout generation. The 310-6 IEEE-488 Option provides an IEEE-488 interface. Refer to Section 4 when the selected interface drives a printer. Refer to Section 5 when the selected interface is connected to a computer or terminal for remote operation. The PRINT auxiliary group is described as follows:

#### INTERVAL — Timed Printout Interval




The INTERVAL auxiliary function allows you to select the amount of time between printouts when the **PRINT EVENT** switch is set to TIMED. The maximum time that can be entered is 24 hours 59 minutes. The minimum time that can be entered is 00 hours 01 minute. Press the **RESULTS I Results** switch to set the hours from 0 to 24 hours. Press the **RESULTS II Results** switch to set the minutes from 00 to 59 minutes. The printout format is determined by the FORMAT and MODE auxiliary functions.

#### MODE — Printout Mode



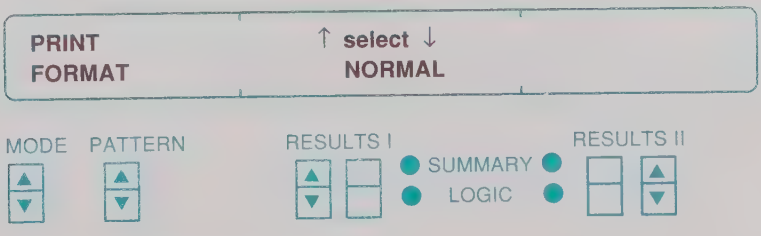

The MODE auxiliary function selects how the results are accumulated for all **PRINT EVENT** switch positions. Press the **RESULTS I Results** switch to select one of the following:

**CONTINUOUS** — Results are continuously accumulated for the duration of the test.

**DELTA** — Results are accumulated between each printout. As the printout is sent to the print buffer, the test result counters are zeroed out.

NOTE: The DELTA mode selection does not affect front-panel results, power-down *results* printouts, squelch-off *results* printouts, and manual *results* printouts.

## FORMAT — Printout Format



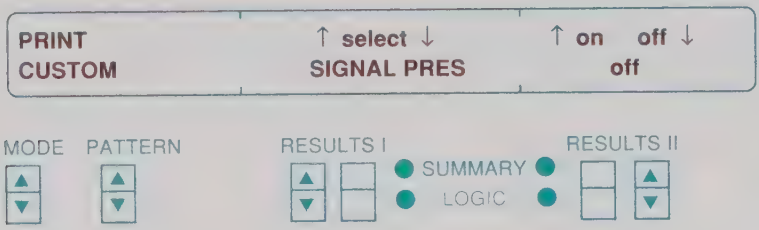

The FORMAT auxiliary function selects the format for the *results* printouts. Press the **RESULTS I Results** switch to select one of three formats:

**NORMAL** — The NORMAL RESULTS PRINT lists the Primary (and Secondary) Status and Alarm LEDs and all results by category for the current T-BERD 310 configuration.

**CUSTOM** — The CUSTOM RESULTS PRINT lists the Primary (and Secondary) Status and Alarm LEDs and results by category selected from the CUSTOM auxiliary function.

**SUMMARY** — The SUMMARY RESULTS PRINT lists the Primary (and Secondary) Status and Alarm LEDs and current SUMMARY category results.

### CUSTOM — Customized Printout Contents




The CUSTOM auxiliary function selects specific test results and Status and Alarm LED conditions to be included in a custom *results* printout. Press the **RESULTS** switches to select the desired printout line items:

**RESULTS I Category switch** — Press this switch to select the desired category. The Status and Alarm LEDs and FEAC codes are selected from the SUMMARY category.

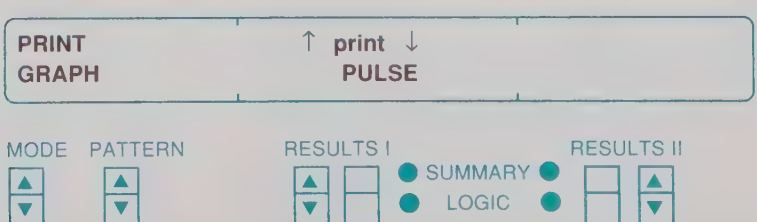
**RESULTS I Results switch** — Press this switch to select the results and LEDs.

**RESULTS II Results switch** — Press the up arrow to toggle ON or the down arrow to toggle OFF the status condition.

NOTE: To generate a custom *results* printout, set the FORMAT auxiliary function to CUSTOM.

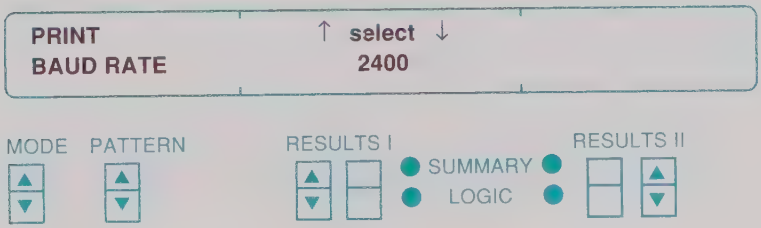
Refer to Section 3.11 for the list of categories and results. If the 310-3 DS1 Insert Option is installed, the **RESULTS I SECONDARY** switch can be pressed to select the desired secondary DS3 results for the customized *results* printout.

### GRAPH — Print Graph



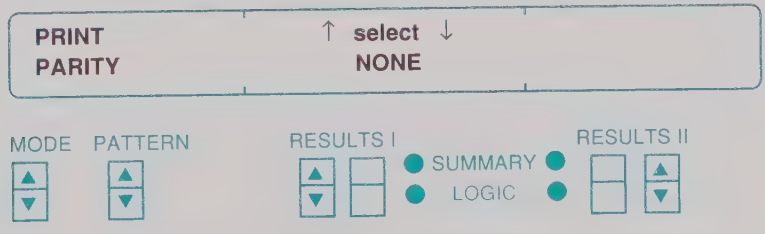

The GRAPH auxiliary function generates the pulse shape graph printout. Press the **RESULTS I Results** switch to print the pulse shape graph.

### BAUD RATE — RS-232 Interface Baud Rate




The BAUD RATE auxiliary function selects the RS-232 interface baud rate. Press the **RESULTS I Results** switch to select one of the following: 110, 300, 600, 1200, 2400, 4800, or 9600.

### PARITY — RS-232 Interface Parity



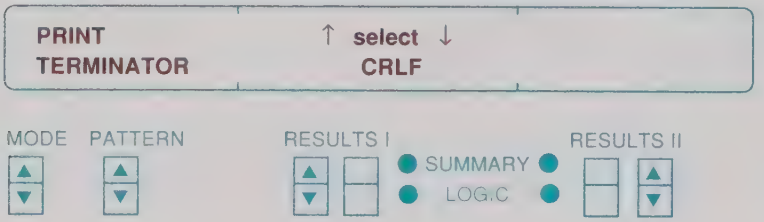

The PARITY auxiliary function selects the RS-232 interface parity. Press the **RESULTS I Results** switch to select one of the following:

**NONE** — Parity is disabled and the data output is configured for an 8-bit character length. Parity must be set to NONE to print the pulse shape graph.

**EVEN** — Even parity is enabled with the data output configured for a 7-bit character length.

**ODD** — Odd parity is enabled with the data output configured for a 7-bit character length.

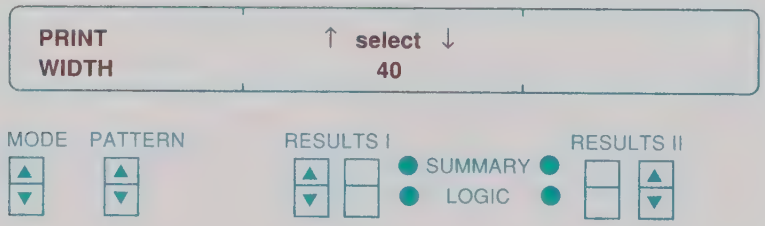
### TERMINATOR — Printout Line Terminator




The TERMINATOR auxiliary function selects the end-of-line terminator characters for both printouts and remote control devices. Press the **RESULTS I Results** switch to select one of the following line terminator characters:

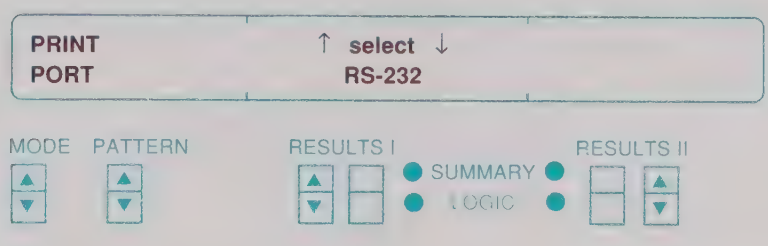
**CRLF** — Carriage Return and Linefeed
**CR** — Carriage Return
**LF** — Linefeed

### WIDTH— Printout Line Width




The WIDTH auxiliary function selects the character line width for printouts and terminal displays. Press the **RESULTS I Results** switch to select either a 40- or 80-column width.

## PORT — Printer/Remote Control Interface Port Selection



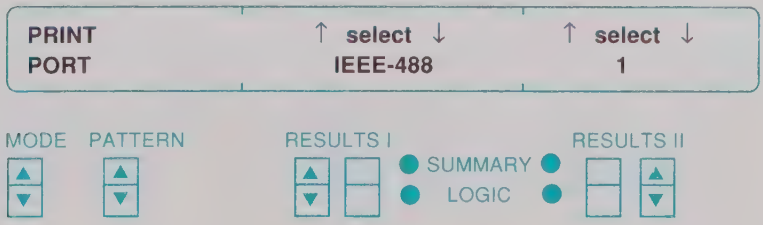

The PORT auxiliary function selects between the RS-232 or 310-6 IEEE-488 Option interface for printer or remote control operation.

NOTE: This auxiliary function only appears when the 310-6 IEEE-488 Option is installed.

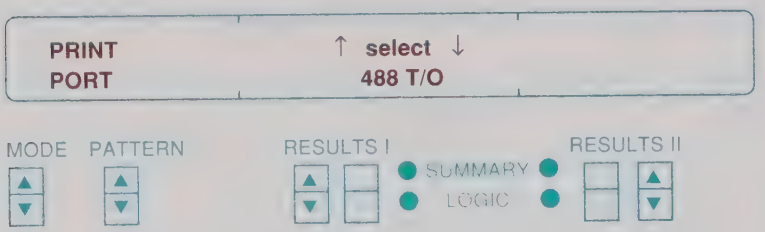
Press the **RESULTS I Results** switch to select between the RS-232 and IEEE-488 interfaces. The IEEE-488 interface has two selections:

**RS-232** — This selects the side-panel RS-232 interface for printer or remote control operation.

**Addressable IEEE-488** — This selects the side-panel IEEE-488 interface for remote control operation from a compatible IEEE-488 controller. Press the **RESULTS II Results** switch to select the bus address from 0 to 30 for the T-BERD 310.



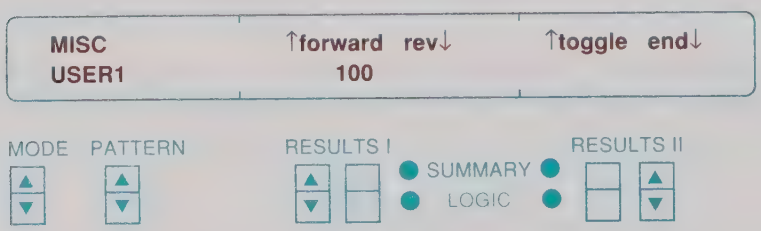

**488 T/O** — The IEEE-488 talk-only mode enables the T-BERD 310 to drive a compatible IEEE-488 listen-only printer from the side-panel IEEE-488 interface.




### 3.10.6 MISC — Miscellaneous Group

The MISC auxiliary group controls the user-programmable test pattern, X-bit transmission, Blue Signal detection criteria, DS1 line coding, beep criteria, and the pulse shape mask. The MISC auxiliary group is described as follows:

#### USER1 — User-Programmable Test Pattern

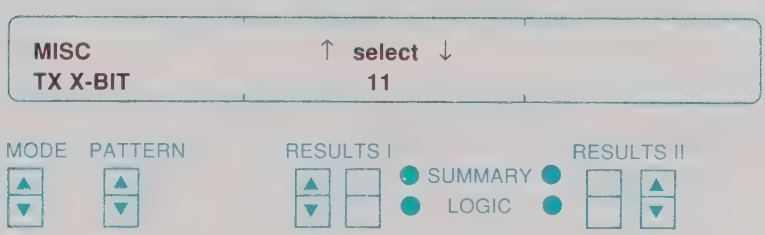



The USER1 auxiliary function programs a 3- to 24-bit user-programmable test pattern. This allows the T-BERD 310 to transmit specific patterns to test circuit sensitivity. The pattern is transmitted when the USER1 pattern is selected with the **PATTERN** switch. The pattern is transmitted in left-to-right order. A test restart of the T-BERD 310 occurs when the pattern is saved while the USER1 pattern is transmitted. The test pattern is programmed with the following switches:

**RESULTS I Results switch —** Press the up arrow to move the cursor forward from left to right. Moving the cursor forward past the last displayed bit automatically inserts a "0" in each new position up to 24 bits. Press the down arrow to move the cursor in reverse from right to left.

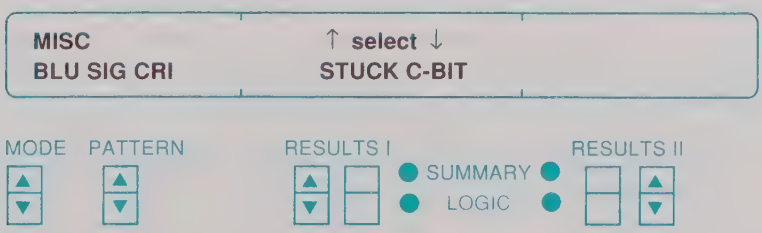
**RESULTS II Results switch** — Press the up arrow to toggle the highlighted bit between "1" and "0". Press the down arrow to end or save the bit pattern from the position of the cursor to the first bit on the left. Any bits to the right of the cursor are deleted when the down arrow is pressed. The pattern is saved when *end* is selected.

### TX X-BIT — X-Bit Transmission




The TX X-BIT auxiliary function determines how the T-BERD 310 transmits the X-bits in all modes except THRU and UNFRAMED. Press the **RESULTS I Results** switch to select the required bit pattern: 11, 00, or EMULATE. In the M13 mode, EMULATE transmits 11 only. In C-BIT or MUXED C-BIT mode, EMULATE allows the X-bits to transmit near-end out-of-frame (NEOOF) conditions (X-bits are zero) to the far end.

### BLU SIG CRI — Blue Signal Detection Criteria

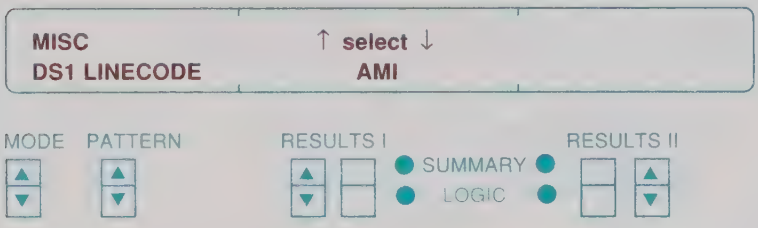



The BLU SIG CRI auxiliary function selects the Blue Signal detection criteria. Press the **RESULTS I Results** switch to select one of the following detection criteria:

**STUCK C-BIT** — The T-BERD 310 declares a Blue Signal based primarily on receiving a signal with the C-bits set to zero.

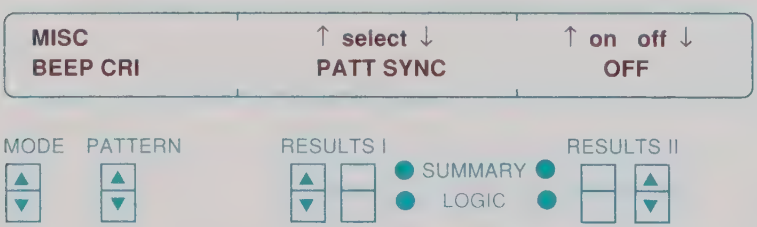
**1010** — The T-BERD 310 declares a Blue Signal if the received signal contains a 1010 pattern.

### DS1 LINECODE — DS1 Drop Output Line Coding




The DS1 LINECODE auxiliary function selects the DS1 line code, AMI or B8ZS, for the side-panel DS1 DROP output jack. Press the **RESULTS I Results** switch to select either AMI or B8ZS DS1 line coding.

### BEEP CRI — Beep Criteria



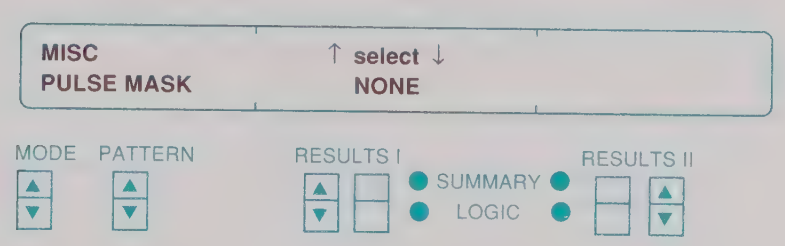

The BEEP CRI auxiliary function selects the criteria for the T-BERD 310 to generate an audible warning. Press the **RESULTS I Results** switch to select the criteria. Press the **RESULTS II Results** switch to toggle the criteria ON or OFF.

**PATT SYNC** — The T-BERD 310 beeps when pattern synchronization occurs (Pattern Sync LED illuminated).

**THR ERR SEC** — The T-BERD 310 beeps once a second when the errored second threshold (ERROR THR auxiliary function) is exceeded (see Section 3.10.2).

**ERROR EVENT** — The T-BERD 310 beeps once a second when one of the following error events occurs: bit errors, BPVs, frame errors, parity errors, or C-bit errors.

### PULSE MASK — Pulse Shape Mask



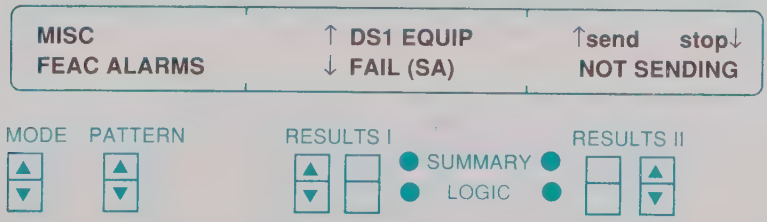

The PULSE MASK auxiliary function selects the pulse mask used to evaluate the received signal pulse shape. The selected pulse mask appears on the pulse shape graph printout (see Section 4). Changing the PULSE MASK causes a test restart. Press the **RESULTS I Results** switch to select one of the following pulse masks:

**NONE** — The pulse shape is not evaluated against a pulse mask specification. However, the pulse shape measurements are still made (see Section 3.11.6). When selected, the PULSE SHAPE result indicates N/A.

**ANSI** — The pulse shape is evaluated against the ANSI T1.102-1991 Network Interface pulse mask specification.

**CCITT** — The pulse shape is evaluated against the proposed CCITT G.703 network interface pulse mask recommendation.

### FEAC ALARMS — FEAC Message Alarm Control




The FEAC ALARMS auxiliary function is used to transmit Far-End Alarm and Control (FEAC) alarm messages. Press the **RESULTS I Results** switch to scroll through the following alarm messages.

**DS3 EQUIP FAIL (NSA)** — DS3 Equipment Failure, Non-Service Affecting (Type 2 equipment failure)

**DS3 LOS/HBER** — DS3 Loss-of-Signal/High Bit Error Ratio

**DS3 AIS RECEIVED** — DS3 Alarm Indication Signal Received

**COMM EQUIP FAIL (NSA)** — Common Equipment Failure, Non-Service Affecting (Type 2 equipment failure)

**DS1 EQUIP FAIL (SA)** — DS1 Equipment Failure, Service Affecting (Type 1 equipment failure)

**MULT DS1 LOS/HBER** — Multiple DS1 Loss-of-Signal/High Bit Error Ratio

**DS3 EQUIP FAIL (SA)** — DS3 Equipment Failure, Service Affecting (Type 1 equipment failure)

**DS3 OUT OF FRAME** — DS3 Out-of-Frame, Loss of DS3 Frame Synchronization

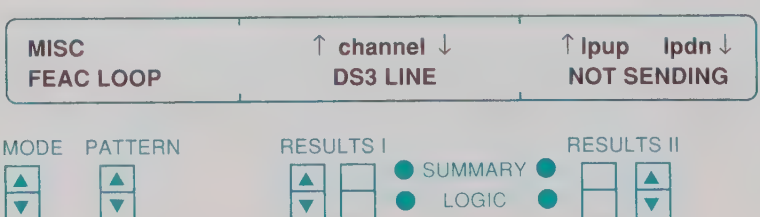
**DS3 IDLE RECEIVED** — DS3 Idle Signal Received

**DS1 EQUIP FAIL (NSA)** — DS1 Equipment Failure, Non-Service Affecting (Type 2 equipment failure)

**SINGLE DS1 LOS/HBER** — Single DS1 Loss-of-Signal/High Bit Error Ratio

Press the **RESULTS II Results** switch up arrow to *send* ("SENDING" appears) the alarm message and the down arrow to *stop* ("NOT SENDING" appears) the message. Only one alarm message is transmitted at one time for one second. The FEAC alarms can only be transmitted in the C-BIT and MUXED C-BIT modes. "N/A" appears in the RESULTS II window when the FEAC alarm messages do not apply to the selected operating mode.

**FEAC LOOP — FEAC Message Loopback Control**



The FEAC LOOP auxiliary function is used to transmit FEAC loop-code messages. The loop-code messages can loop up or loop down the DS3 line, a DS1 channel, or all DS1 channels. The FEAC alarms can only be transmitted in the C-BIT and MUXED C-BIT modes. "N/A" appears in the RESULTS II window when the FEAC loop-code messages do not apply to the selected operating mode. Press the **RESULTS I Results** switch to scroll through the following loop-code messages.

**DS3 LINE** — Loopback the DS3 line at the DS3 multiplexer.

**ALL DS1s** — Loopback all the low-speed DS1 channels at the DS3 multiplexer.

**DS1 #1 - 28** — Loopback the selected low-speed DS1 channel at the DS3 multiplexer.

Press the **RESULTS II Results** switch up arrow to *send* the loop-up code and the down arrow to *send* the loop-down code. When the loop-up code is transmitted, "LOOPING UP" appears in the RESULTS II window until the loopback is established or when one second is exceeded. When the loop-down code is transmitted, "LOOPING DOWN" appears in the RESULTS II window until the loopback is released or when one second is exceeded. "NOT SENDING" appears when the loop code is not being transmitted. Only one loop code can be transmitted at a time.

## 3.11 TEST RESULTS

The primary DS3 receiver has full Bit Error Rate Test (BERT) capabilities and supports all the DS3 results defined in the following sections. Two results can be displayed at one time in the RESULTS I and RESULTS II windows. The **RESULTS I** and **RESULTS II** switches enable the categorized results to be displayed. The **RESULTS I** and **RESULTS II SECONDARY** switches are only functional when the 310-3 DS1 Insert Option is installed (see Section 7).

The available results depend on framing type, pattern synchronization, installed options, etc. Results that are *not available* display the message "UNAVAILABLE" in place of the result count. The results that are *not applicable* to the current mode display "N/A" in place of the result count. When the displayed count exceeds 99,999,999, a ">" (greater than sign) appears in the window. When the number rolls over, the count continues.

### 3.11.1 SUMMARY Category

The SUMMARY category automatically displays key results that are non-zero or out-of-specification. This allows quick access to the results without having to search through the other categories. The results that appear in the SUMMARY category include:

- BIT ERRORS (LOGIC category)
- SLIPS (LOGIC category)
- VIOLATIONS (BPV category)
- PAR ERRORS (PARITY category)
- C-BIT ERRORS (PARITY category)
- FEBE (PARITY category)
- FRM ERRORS (FRAME category)
- DS2 FRM ERR (FRAME category)
- RX FREQ (SIGNAL category)
- FEAC Messages (see Table 3-3)

When all SUMMARY results are error-free, the message "ALL RESULTS OK" is displayed. When an error is detected, the appropriate test result appears in the SUMMARY category window. When more than one error is detected, press either the **RESULTS I Results** switch or **RESULTS II Results** switch to scroll through the results.

The Far-End Alarm and Control (FEAC) messages listed in Table 3-3 are displayed in the SUMMARY category. These messages remain present until the test is restarted. These messages comply with the ANSI T1.107a-1990 standard.

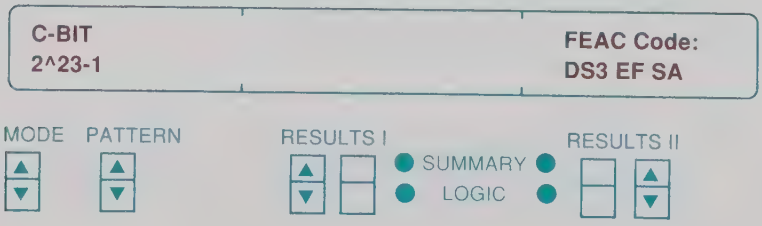


**Table 3-3**
**Far-End Alarm and Control Messages**

| Message | Description |
|---|---|
| DS3 EF SA | DS3 Equipment Failure, Service Affecting (Type 1 equipment failure) |
| DS3 L/H | DS3 Loss-of-Signal/High Bit Error Ratio |
| DS3 OOF | DS3 Out-of-Frame, Loss of DS3 Frame Synchronization |
| DS3 AIS RX | DS3 Alarm Indication Signal Received |
| DS3 IDLE RX | DS3 Idle Signal Received |
| DS3 EF NSA | DS3 Equipment Failure, Non-Service Affecting (Type 2 equipment failure) |
| COMM EF NSA | Common Equipment Failure, Non-Service Affecting (Type 2 equipment failure) |
| MULT DS1 L/H | Multiple DS1 Loss-of-Signal/High Bit Error Ratio |
| DS1 EF SA | DS1 Equipment Failure, Service Affecting (Type 1 equipment failure) |
| SING DS1 L/H | Single DS1 Loss-of-Signal/High Bit Error Ratio |
| DS1 EF NSA | DS1 Equipment Failure, Non-Service Affecting (Type 2 equipment failure) |

### 3.11.2 LOGIC Category

Logic errors are based on discrepancies between the transmitted and received bit stream. The accumulation of logic errors is dependent on frame synchronization (if in a framed mode) and pattern synchronization. Logic errors are not available until initial pattern synchronization is obtained. The results are also not available when transmitting a channelized test pattern (i.e.,

the operating mode is set for MUXED M13 or MUXED C-BIT). During loss of frame or pattern synchronization, the accumulation of errors is halted. The LOGIC category results are defined as follows:

**BIT ERRORS**

***Bit Errors*** — The number of received pattern bits which have a value opposite that of the corresponding transmitted bit pattern since initial DS3 pattern synchronization.

**BIT ERR RT**

***Bit Error Rate*** — The ratio of pattern bit errors to received pattern bits over the previous block of $10^8$ bits.

**AV BIT ERT**

***Average Bit Error Rate*** — The ratio of pattern bit errors to the total number of received pattern bits while DS3 pattern synchronization is present.

**BIT ERR SEC**

***Bit Errored Seconds*** — The number of seconds during which one or more pattern bit errors occurred since initial DS3 pattern synchronization.

**BIT %EFS**

***Bit, Percentage of Error-Free Seconds*** — The ratio, expressed as a percentage, of seconds during which no pattern bit errors were detected, to the total number of seconds while DS3 pattern synchronization is present.

**BIT THR ES**

***Bit, Threshold Errored Seconds*** — The number of seconds during which the pattern bit error rate exceeded or equaled the user-defined threshold. The threshold is set through the ERROR THR auxiliary function (see Section 3.10.2).

**SYNC ES**

***Synchronous Errored Seconds*** — The number of seconds during which at least one pattern bit error has occurred. Each second is initiated by, and synchronized to, a pattern bit error.

**SYNC L SEC**

***Synchronization Loss Seconds*** — The number of seconds during which the receiver has lost pattern synchronization, even momentarily, since initial DS3 pattern synchronization.

**SLIPS**

***Slips*** — The number of times the received pattern becomes skewed relative to the expected (i.e., internally generated) test pattern. When a slip is detected, the T-BERD 310 automatically resynchronizes to the received pattern. However, pattern bit errors are not suppressed during this process. Pattern slips are available only when using pseudorandom patterns.

## 310-10 G.821 Results Option

The 310-10 G.821 Results Option enables the T-BERD 310 to evaluate the long-term performance of your system. The option adds eight performance analysis results to the LOGIC category. The G.821 performance results are defined as follows:

**AVAIL SEC**

***Available Seconds*** — A count of elapsed seconds since pattern synchronization in which the bit error rate is less than $10^{-3}$.

**%AVAIL SEC**

***% Available Seconds*** — The ratio, expressed as a percentage, of available seconds to the total elapsed seconds since pattern synchronization.

**SEV ERR SEC**

***Severely Errored Seconds*** — A count of seconds during which the bit error rate is worse than $10^{-3}$ within the available time.

**%SEV ER SEC**

***% Severely Errored Seconds*** — The ratio, expressed as a percentage, of severely errored seconds to the number of available seconds.

**CSES**

***Consecutive Severely Errored Seconds*** — A count of three or more contiguous severely errored seconds in which a bit error rate worse than $10^{-3}$ in each second.

**DEG MIN**

***Degraded Minutes*** — A count of minutes during which the bit error ratio is worse than $10^{-6}$ and less than $10^{-3}$.

**%DEG MIN**

***% Degraded Minutes*** — The ratio, expressed as a percentage, of degraded minutes to the number of available non-severely errored minutes.

**UNAVAIL SEC**

***Unavailable Seconds*** — A count of elapsed seconds since pattern synchronization in which the bit error rate is greater than or equal to $10^{-3}$.

## Measuring DS3 Signal Performance

The G.821 results are only available after gaining initial pattern synchronization in any DS3 framing mode except MUXED M13, MUXED C-BIT, and AUTO when live data is transmitted. After gaining initial pattern synchronization from the PRIMARY DS3 RECEIVE INPUT jack, the G.821 results, except for the degraded minute results, are directly affected by signal, frame, and pattern loss. When DS3 pattern synchronization is achieved from a SONET source, the G.821 results, except for the degraded minute results, are directly affected by the SONET signal and frame loss.

CCITT Recommendation G.821 defines available and unavailable time as follows:

*A period of unavailable time begins when the bit error rate in each second is worse than $10^{-3}$ for 10 consecutive seconds. These 10 seconds are considered to be unavailable time. The period of unavailable time terminates when the bit error rate in each second is better than $10^{-3}$ for 10 consecutive seconds. These 10 seconds are considered to be available time.*

Available and unavailable times are measured in seconds — available seconds (AVAIL SEC) and unavailable seconds (UNAVAIL SEC), respectively. All test seconds must fall into one of the two categories (total available seconds + total unavailable seconds = total test seconds).

At the beginning of a test, test seconds are considered to be available time; the available seconds begin counting. These seconds continue to be counted until 10 consecutive seconds occur each with a bit error rate worse than $10^{-3}$. A sliding window, 10 seconds in length, is used to detect this transition from available to unavailable time and vice versa.

Degraded minutes (DEG MIN) is an error analysis result that is affected by available and unavailable time. DEG MIN is a count of the number of minutes during which an average bit error rate worse than $10^{-6}$, but better than $10^{-3}$, occurs. The 1-minute intervals are derived by removing unavailable seconds and severely error seconds from the total test time and then consecutively grouping the remaining seconds into blocks of 60. The average bit error rate is calculated for the block of 60 seconds and, if it is worse than $10^{-6}$, the block is counted as a degraded minute.

In the transition from available time to unavailable time, the DEG MIN result is unaffected. This is because a switch to unavailable time requires 10 consecutive seconds each

with a bit error rate worse than $10^{-3}$. Any second in available time with a bit error rate worse than $10^{-3}$ is considered to be a severely errored second and, therefore, is not included in the accumulation of seconds used to calculate degraded minutes.

Moving from unavailable time to available time may affect the DEG MIN count. While in unavailable time, 10 consecutive seconds each with a bit error rate better than $10^{-3}$ are required for the transition to available time. When this happens, those 10 seconds are subtracted from the UNAVAIL SEC count and are added to the available seconds count. Since these seconds are now considered to be a part of available time and they are not severely errored seconds, they are included in the calculation of degraded minutes.

### 3.11.3 BPV Category

Bipolar violations are caused by successive DS3 pulses with the same polarity being detected (except those pulses that are part of the B3ZS encoding). Bipolar violation results are only accumulated when the signal is present. The BPV category results are defined as follows:

**VIOLATIONS**

***Bipolar Violations*** — The number of bipolar violations (BPVs) detected since the beginning of the test. Intentional B3ZS code violations are excluded from the count.

**BPV ERR RT**

***BPV Error Rate*** — The ratio of BPVs to received bits over the previous block of $10^8$ bits.

**AV BPV ERT**

***Average BPV Error Rate*** — The ratio of BPVs to the total number of received bits since the beginning of the test.

**BPV ERR SEC**

***BPV Errored Seconds*** — The number of seconds during which one or more BPVs occurred since the beginning of the test.

**BPV %EFS**

***BPV, Percentage of Error-Free Seconds*** — The ratio, expressed as a percentage, of seconds during which no BPVs were detected, to the total number of seconds since the beginning of the test.

**BPV THR ES**

***BPV Threshold Errored Seconds*** — The number of seconds during which the BPV rate exceeded or equaled the user-defined threshold. The threshold is set through the ERROR THR auxiliary function (see Section 3.10.2).

### 3.11.4 PARITY Category

The PARITY category results depend on the current framing mode and the received framing signal. The PARITY category results are defined as follows:

**PAR ERRORS**

***Parity (P-bit) Errors*** — The number of parity errors detected since initial DS3 frame synchronization.

**PAR ERR RT**

***Parity (P-bit) Error Rate*** — The ratio of parity errors to (1) the number of bits over which parity was calculated (Bit mode), or (2) the number of DS3 M-frames received (Block mode). The error rate is computed over the previous block of $10^8$ bits. The result is derived as a bit or block error rate based on the setting of PAR ERR RT auxiliary function (see Section 3.10.2).

**AV PAR ERT**

***Average Parity (P-bit) Error Rate*** — The ratio of parity errors to (1) the number of bits over which parity was calculated (Bit mode), or (2) the number of DS3 M-frames received (Block mode). The error rate is computed while DS3 frame synchronization is present. The result is derived as a bit or block error rate based on the setting of the PAR ERR RT auxiliary function (see Section 3.10.2).

**PAR ERR SEC**

***Parity (P-bit) Errored Seconds*** — The number of seconds during which one or more parity errors occurred since initial DS3 frame synchronization.

**PAR %EFS**

***Parity (P-bit), Percentage of Error-Free Seconds*** — The ratio, expressed as a percentage, of seconds during which no parity errors were detected, to the total number of seconds while DS3 frame synchronization is present.

**C-BIT ERRORS**

***C-bit Parity Errors*** — The number of parity errors detected since initial DS3 C-bit frame synchronization.

**C-BIT ERR RT**

***C-bit Parity Error Rate*** — The ratio of C-bit parity errors to (1) the number of bits over which C-bit parity was calculated (Bit mode), or (2) the number of DS3 C-bit M-frames received (Block mode). The error rate is computed over the previous block of $10^8$ bits. The result is derived as a bit or block error rate based on the setting of the PAR ERR RT auxiliary function (see Section 3.10.2).

**AV C-BIT ERT**

***Average C-bit Parity Error Rate*** — The ratio of C-bit parity errors to (1) the number of bits over which C-bit parity was calculated (Bit mode), or (2) the number of DS3 C-bit M-frames received (Block mode). The error rate is computed while DS3 C-bit frame synchronization is present. The result is derived as a bit or block error rate based on the setting of the PAR ERR RT auxiliary function (see Section 3.10.2).

**C-BIT TYPE A**

***C-bit Parity Errored Seconds, Type A*** — The number of seconds during which one and only one C-bit parity error occurred since initial DS3 C-bit frame synchronization.

**C-BIT TYPE B**

***C-bit Parity Errored Seconds, Type B*** — The number of seconds during which 2 to 44 C-bit parity errors occurred since initial DS3 C-bit frame synchronization.

**C-BIT TYPE C**

***C-bit Parity Errored Seconds, Type C*** — The number of seconds during which more than 44 C-bit parity errors occurred since initial DS3 C-bit frame synchronization.

**C-BIT %EFS**

***C-bit Parity, Percentage of Error-Free Seconds*** — The ratio, expressed as a percentage, of seconds during which no C-bit parity errors were detected, to the total number of seconds while DS3 C-bit frame synchronization is present.

**FEBE**

***Far-End Block Errors*** — The number of far-end block errors (FEBEs) detected since initial DS3 C-bit frame synchronization.

**FEBE RT**

***Far-End Block Error Rate*** — The ratio of FEBEs to (1) the number of bits over which C-bit parity was calculated (Bit mode), or (2) the number of DS3 C-bit M-frames received (Block mode). The error rate is computed over the previous block of $10^8$ bits. The result is derived as a bit or block error rate based on the setting of the PAR ERR RT auxiliary function (see Section 3.10.2).

**AV FEBE RT**

***Average Far-End Block Error Rate*** — The ratio of FEBEs to (1) the number of bits over which C-bit parity was calculated (Bit mode), or (2) the number of DS3 C-bit M-frames received (Block mode). The error rate is computed while DS3 C-bit frame synchronization is present. The result is derived as a bit or block error rate based on the setting of the PAR ERR RT auxiliary function (see Section 3.10.2).

**FEBE TYPE A**

***Far-End Block Errored Seconds, Type A*** — The number of seconds during which one and only one FEBE occurred since initial DS3 C-bit frame synchronization.

**FEBE TYPE B**

***Far-End Block Errored Seconds, Type B*** — The number of seconds during which 2 to 44 FEBEs occurred since initial DS3 C-bit frame synchronization.

**FEBE TYPE C**

***Far-End Errored Seconds, Type C*** — The number of seconds during which more than 44 FEBEs occurred since initial DS3 C-bit frame synchronization.

**FEBE %EFS**

***Far-End Block Error, Percentage of Error-Free Seconds*** — The ratio, expressed as a percentage, of seconds during which no FEBEs were detected, to the total number of seconds while DS3 C-bit frame synchronization is present.

### 3.11.5 FRAME Category

Frame errors are based on counting framing bits and identifying frame errors in the incoming DS3 signal after initial frame synchronization. The results are available whenever the receiver detects a valid M13 or C-bit parity framed signal, regardless of the transmitter framing mode. The FRAME category results are defined as follows:

**FRM ERRORS**

***Frame Errors*** — The number of frame errors detected since initial DS3 frame synchronization.

**FRM ERR RT**

***Frame Error Rate*** — The ratio of frame errors to received framing bits over the previous block of $10^8$ bits.

**AV FRM ERT**

***Average Frame Error Rate*** — The ratio of frame errors to the total number of received framing bits while DS3 frame synchronization is present.

**FRM ERR SEC**

***Frame Errored Seconds*** — The number of seconds during which one or more frame errors occurred since initial DS3 frame synchronization.

**FRM %EFS**

***Frame, Percentage of Error-Free Seconds*** — The ratio, expressed as a percentage, of seconds during which no frame errors were detected, to the total number of seconds while DS3 frame synchronization is present.

**FRM THR ES**

***Frame Threshold Errored Seconds*** — The number of seconds during which the frame error rate exceeded or equaled the user-defined threshold. The threshold is set through the ERROR THR auxiliary function (see Section 3.10.2).

**FEOOF SEC**

***Far-End Out-of-Frame Seconds*** — The number of seconds during which the received X-bits are zero within the one second interval.

**NEOOF SEC**

***Near-End Out-of-Frame Seconds*** — The number of seconds during which an out-of-frame condition or an AIS (Alarm Indication Signal) is detected.

**DS2 FRM ERR**

***DS2 Frame Errors*** — The number of DS2 frame errors detected since initial DS2 frame synchronization. The result applies only to the DS2 signal that contains the DS1 channel being dropped. The count is reset when the selected dropped channel is changed such that the new channel being dropped corresponds to a different DS2 signal. Table 3-4 identifies the DS2 channels and the corresponding DS1 channels.

Table 3-4
DS2 Channels vs. the Dropped DS1 Channels

| Signal | Channels | | | | | | |
|---|---|---|---|---|---|---|---|
| DS2 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| DS1 | 1-4 | 5-8 | 9-12 | 13-16 | 17-20 | 21-24 | 25-28 |

**DS2 FRM ERT**

***DS2 Frame Error Rate*** — The ratio of detected DS2 frame errors to the total DS2 framing bits received. The result applies only to the DS2 signal that contains the DS1 channel being dropped. The count is reset when the selected dropped DS1 channel is changed such that the new channel being dropped corresponds to a different DS2 signal. Table 3-4 identifies the DS2 channels and the corresponding DS1 channels.

**DS2 AV F ERT**

***DS2 Average Frame Error Rate*** — The ratio of DS2 frame errors to the total number of received framing bits while DS2 frame synchronization is present.

**TX X-BIT**

***Transmitted X-bit*** — The current setting of the transmitted X-bits when in a framed mode. The transmitted X-bits are set through the TX X-BIT auxiliary function (see Section 3.10.6).

**RX X-BIT**

***Received X-bit*** — The current status of the received X-bits when in a framed mode. The result is available after receiving DS3 frame synchronization.

**FRM LOSS CNT**

***DS3 Frame Loss Count*** — The number of DS3 frame losses occurring after initial frame synchronization.

### 3.11.6 SIGNAL Category

The SIGNAL category results include signal loss seconds, frequency, power, level, and pulse shape measurements. If the 310-5 DS3 Jitter Option is installed, jitter amplitude results are also included in the SIGNAL category (see Section 10). The results are accumulated after initial signal detection. The SIGNAL category results are defined as follows:

**SIG L SEC**

***Signal Loss Seconds*** — The number of seconds during which the received DS3 signal was lost for all or part of a second since initial signal detection.

**TX FREQ**

***Transmit Frequency*** — The frequency of the transmit clock measured in Hz.

**RX FREQ**

***Receive Frequency*** — The frequency of the clock recovered from the received data measured in Hz.

**POWER**

***Receive Signal Power*** — The power level of the received DS3 signal measured in dBm.

**LEVEL**

***Receive Signal Level*** — The level of the received DS3 signal in volts peak.

**PULSE SHAPE**

***Pulse Shape*** — A PASS/FAIL result which shows whether the DS3 pulse shape is within the boundary of the specified pulse mask. The pulse shape mask is set through the PULSE MASK auxiliary function (see Section 3.10.6).

**PULSE WIDTH**

***Pulse Width*** — The pulse width of the DS3 pulse measured in nanoseconds.

**RISE TIME**

***Pulse Rise Time*** — The time interval between the 10% and 90% points of the rising edge of the DS3 pulse measured in nanoseconds.

**FALL TIME**

***Pulse Fall Time*** — The time interval between the 10% and 90% points of the falling edge of the DS3 pulse measured in nanoseconds.

### 3.11.7 SONET Category

The SONET category is only available when a SONET drop option is installed. Refer to Section 8 for information on the SONET category results.

### 3.11.8 TIME Category

The TIME category lists current date, time, and timed results. The TIME category results are defined as follows:

**TIME**

***Current Time of Day*** — The current time of day in hours, minutes, and seconds. The time is set through the SET TIME auxiliary function (see Section 3.10.4).

**DATE**

***Current Date*** — The current day and month. The date is set through the SET DATE auxiliary function (see Section 3.10.4).

**ELAPSED TIME**

***Elapsed Time*** — The elapsed time in hours, minutes, and seconds since the last test restart.

**TEST LENGTH**

***Timed Test Length*** — The currently set test length for a timed test in hours and minutes. The test length is set through the TEST LENGTH auxiliary function (see Section 3.10.4).

**TIME LEFT**

***Timed Test Time Left*** — The time remaining for a timed test in hours, minutes, and seconds.

# SECTION 4
# PRINTER OPERATION

# PRINTER OPERATION

## 4.1 INTRODUCTION

The T-BERD 310 can generate four types of printouts: *results*, *controls*, *pulse shape*, and *messages*. This section describes each of the printouts and how to generate them using either the RS-232-C or IEEE-488 interface (310-6 IEEE-488 Option required).

## 4.2 COMPATIBLE PRINTERS

The T-BERD 310 generates printouts to either an RS-232-compatible serial or an IEEE-488-compatible listen-only, graphics dot-matrix printer. A graphics printer (TTC PR-40A or equivalent) is required to print the *pulse shape* printout. Table 4-1 lists the printer configurations available with the T-BERD 310.

**Table 4-1**
**T-BERD 310 Printer Capabilities**

| Function | Selections |
|---|---|
| Printer Interfaces | *RS-232-C* — female 25-pin D connector<br>*IEEE-488* — parallel connector |
| Data Rate | *RS-232-C* — 110, 300, 600, 1200, 2400, 4800, or 9600 b/s<br>*IEEE-488* — 300 words per second |
| Character Length | *RS-232-C* — seven bits with parity or eight bits without parity<br>*IEEE-488* — eight bits |
| Line Terminator | *RS-232-C* — CR, LF, or CRLF<br>*IEEE-488* — CR, LF, or CRLF with EOI |
| Flow Control | *RS-232-C* — DTR/CTS and in-band XON/XOFF supported |

Table 4-1
T-BERD 310 Printer Capabilities (Continued)

| Function | Selections |
|---|---|
| Parity | *RS-232-C* — odd, even, or none |
| Interface Configuration | *RS-232-C* — DCE<br>*IEEE-488* — talk only or addressable |
| Start Bits | *RS-232-C* — one bit |
| Stop Bits | *RS-232-C* — two bits on transmit, one or more on receive |
| Column Width | 40 or 80 |
| Timing | *RS-232-C* — Asynchronous |
| Character Format | ASCII |

## 4.3 T-BERD 310 PRINTER SETUP

This section describes the connections, controls, indicators, and auxiliary functions used to set up the printer and T-BERD 310.

### 4.3.1 Printer Connections

The RS-232 interface is located on the side panel of the T-BERD 310. The connector is configured as a Data Communications Equipment (DCE) connection, which allows you to connect the T-BERD 310 to Data Terminal Equipment (DTE). Connecting to another DCE, such as a modem, is possible using a DCE/DCE adaptor cable. Table 4-1 list the available selections to configure the RS-232 connector. Refer to Section 11 for the RS-232 pin assignments.

### 4.3.2 Front-Panel Printer Controls

Printout generation is controlled by the front-panel **PRINT** and **PRINT EVENT** switches (see Figure 4-1).

#### PRINT Switch

The **PRINT** switch initiates either a *results* or *controls* printout. For more information, refer to Section 3. The switch positions and their functions are described as follows:

**RESULTS** — Pressing the **RESULTS** position initiates a date- and time-stamped printout of the current T-BERD 310 results. Refer to Section 4.4.1. The printout format is selected through the FORMAT auxiliary function (see Section 4.3.3).

**CONTROLS** — Pressing the **CONTROLS** initiates a date- and time-stamped printout of the current front-panel configuration. Refer to Section 4.4.2.

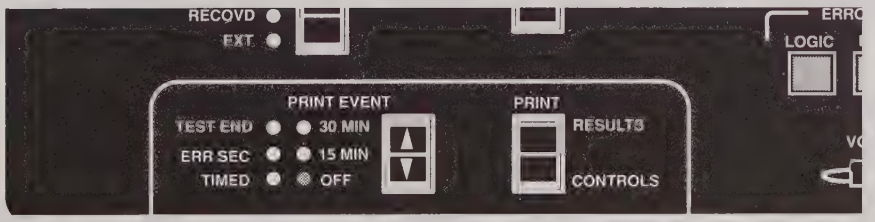



**Figure 4-1**
**Printout Controls and Indicators**

### PRINT EVENT Switch

The **PRINT EVENT** switch selects the event that automatically initiates a *results* printout. The labeled LEDs illuminate to reflect the position of the switch. When a print event is selected (other than OFF), the following conditions can occur:

- A *results* printout is generated at the indicated time or event.
- Status or alarm messages are automatically generated as appropriate.
- At power-up, the power-down *results* printout is generated.
- The printer squelch function is enabled.
- A test end *results* printout occurs if a timed test is completed.

The switch positions and their functions are described as follows:

**OFF** — The print event functions are disabled, and the status or alarm messages are not printed. A manual *results* printout can be generated at any time using the **PRINT** switch.

**15 MIN** — A *results* printout is generated every 15 minutes after test restart.

**30 MIN** — A *results* printout is generated every 30 minutes after test restart.

**TEST END** — A *results* printout is generated when the timed test has expired. The timed test is selected when the **TEST** switch is set to TIMED. The TEST LENGTH auxiliary function controls the test interval. See Section 3.10.4. This selection only allows the test end *results* printout to be generated.

**ERR SEC** — A *results* printout occurs for every occurrence of an errored second after test restart.

**TIMED** — A *results* printout is generated at a user-specified interval. The *print* interval is set using the INTERVAL auxiliary function. The MODE auxiliary function sets the print mode. See Section 3.10.5.

**NOTE:** If any of the print events (except OFF) are selected and the **TEST** switch is set to TIMED, the selected print event (e.g., 30 MIN) and the test end *results* printouts are generated at the appropriate time.

### 4.3.3 PRINT Auxiliary Group

The PRINT auxiliary group controls the operation and printout generation when using either the RS-232-C or the IEEE-488 (310-6 IEEE-488 Option required) interface.

Table 4-2 shows the auxiliary functions used to configure the interface parameters. The default RS-232 interface settings match the TTC PR-40A printer default parameters. Refer to Section 3.10.5 for additional information on the PRINT auxiliary function group.

**Table 4-2**
**Printer Control Parameters**

| Auxiliary Function | Definition | Selections |
|---|---|---|
| INTERVAL | Timed Printout Interval | 0 to 24 Hours/00 to 59 minutes |
| MODE | Print Mode | CONTINUOUS or DELTA |
| FORMAT | Printout Format | NORMAL, CUSTOM, or SUMMARY |
| CUSTOM | Customized Printout Contents | Category,Test Result, or LED/ON or OFF |
| GRAPH | Print Graph | Print PULSE |
| BAUD RATE | RS-232 Interface Baud Rate | 110, 300, 600, 1200, 2400, 4800, or 9600 |
| PARITY[1] | RS-232 Interface Parity | EVEN, ODD, or NONE |
| TERMINATOR | Line Terminator | CR, LF, or CRLF |
| WIDTH | Printout Line Width | 40 or 80 |
| PORT (optional) | Printer/Remote Control Interface Selection | RS-232, IEEE-488/bus 0 to 30, or 488 T/O |

[1] Word length is controlled by the parity selection, seven bits for odd or even parity and eight bits for no parity.

## 4.4 PRINTOUTS

The T-BERD 310 generates four types of printouts: *controls, test results, status messages, and pulse shape*. If a printer is not connected to the instrument, the printouts can be generated and stored in a 20-kbyte print buffer. Depending on the type of printout generated, up to approximately 20 results printouts, 80 controls printouts, 400 status and alarm messages, or 9 pulse shapes can be stored in the print buffer. If the print buffer is full and a printer is not connected or is off line, the first and the most recent printouts are retained while any newly generated printouts overwrite ones stored in the middle of the print buffer queue.

In the event of a power loss, a power-down test *results* printout is also stored. When power is restored, the printout is generated along with any other stored printouts.

### 4.4.1 Results Printouts

A *results* printout is a hard-copy list of the results accumulated during a test. Figure 4-2 illustrates a sample *results* printout. The following information describes the *results* printout in Figure 4-2.

#### Printout Formats

The format is identified across the top of the *result* printout. The format is selected through the FORMAT auxiliary function. Depending on the configuration of the T-BERD 310, additional information, Status and Alarm LEDs, and test results may be reported.

**NORMAL RESULTS PRINT** — Lists all Status and Alarm (current and history) LEDs and test results for primary and secondary inputs.

**CUSTOM RESULTS PRINT** — Lists the user-selected Status and Alarm LEDs and test results for primary and secondary inputs. The individual results and LEDs are selected through the CUSTOM auxiliary function.

**SUMMARY RESULTS PRINT** — Lists the Status and Alarm LEDs, the SUMMARY category results or messages, and the far-end alarm (FEAC) messages for primary and secondary inputs.

```
          NORMAL RESULTS PRINT
-------------------------------------
Test End                        JUN 22
Continuous                   08:46:01
-------------------------------------
            DS3 TEST RESULTS
    ---------------------
  PRIMARY DS3 STATUS
    ---------------------
      Signal Present:              ON
      Frame Sync:                  ON
      C-Bit Frame:                 OFF
      Idle Present:                OFF
      DS2 Frame Sync:              OFF
      Pattern Sync:                ON
      SONET Present:               OFF

  PRIMARY DS3 ALARMS        HIST  CURR
    ---------------------------------
      Signal Loss:              OFF   OFF
      Frame Loss:               OFF   OFF
      DS2 Frame Loss:           OFF   OFF
      Pattern Loss:             OFF   OFF
      Blue (AIS):               OFF   ON
      Yellow:                   OFF   OFF
      Far-End Alarm:            OFF   OFF
      SONET Loss:               OFF   OFF
      Power Loss:               OFF   -

  LOGIC
    ---------------------
      Bit Err:                        1
      Bit Err Rate:           1. E-08
      Avg Bit Err Rate:       8. E-09
```

**Figure 4-2**
**DS3 RESULTS PRINT**

## Print Type

The print type identifies how the printout was generated. The print types include:

**15-Minute Timed Results** — Indicates that the **PRINT EVENT** switch was set to 15 MIN.

**30-Minute Timed Results** — Indicates that the **PRINT EVENT** switch was set to 30 MIN.

**Errored Second Results** — Indicates that the **PRINT EVENT** switch was set to ERR SEC.

**Manual** — Indicates that the **PRINT** switch was pressed to initiate the *results* printout.

**Power Down** — Initiated by a power loss. The printout is generated immediately after power up.

**Squelch Off** — Indicates that the printout was generated after the printer squelch feature has been turned on and then turned off. See Section 4.4.5.

**Test End** — Indicates that the **PRINT EVENT** switch was set to TEST END and that the printout was initiated at the end of a timed test.

**Timed Results** — Indicates that the **PRINT EVENT** switch was set to TIMED and the printout was generated at a specified interval. The test interval is set in the INTERVAL auxiliary function.

## Print Mode

The third line of the *results* printout identifies the print mode (Continuous or Delta) that was used to accumulate the test results during the test. The print mode is selected with the MODE auxiliary function. When the continuous print mode is used, the printed results are continuously accumulated from test restart. When the delta print mode is used, the printed results are accumulated between each automatically generated printout. Each time a printout is generated, the test results stored in the print buffer are reset to zero. Manual and power-down printouts are always printed in continuous mode regardless of the MODE auxiliary function setting. The print mode only affects the printed test results, not the displayed test results.

### Date and Time

The date and time on the printout indicate when the printout was requested; not when it was printed. The printouts are printed in the sequential order as they were requested. The date and time are set through the SET DATE and SET TIME auxiliary functions.

### Status and Alarm LEDs

The printout shows which Primary and Secondary Status and Alarm LEDs are ON or OFF at the time the printout was requested.

### Printed Result

The results are listed by category. The available results depend on the configuration of the T-BERD 310. Results that are *not available* display the message "UNAVAILABLE" in place of the result count. The results that are *not applicable* to the current mode display "N/A" in place of the result count. When the count exceeds 99,999,999, a ">" (greater than sign) precedes the result, the number rolls over, and the count continues.

### End of Printout

A normal *result* printout ends with the message "END OF PRINTOUT". However, if the printout is terminated before it is finished, the message "PRINTOUT TERMINATED BY USER" is issued.

## 4.4.2 Controls Printout

The *controls* printout lists the current setting of the T-BERD 310 front-panel switches and the auxiliary functions. The DS3 CONTROLS PRINT is initiated by pressing the **PRINT CONTROLS** switch. Figure 4-3 is an example of a DS3 CONTROLS PRINT printout.

```
                DS3 CONTROLS PRINT

JUN 22                                  08:18:17

  DS3 PANEL SETTINGS

    Mode:                                   M13
    Pattern:                              2^23-1
    DS3 Source:                        EXTERNAL
    Test Type:                       CONTINUOUS
    TX Timing:                         INTERNAL
    DS1 Insert Channel:             NO STATUS
    DS1 Drop Channel:                       28
    Logic Err Insert:                      OFF
    BPV Err Insert:                        OFF
    Frame Err Insert:                      OFF
    Print Event:                           OFF
    TX Output Level:                       DSX
    RX Input Level:                        DSX

  AUX - ERR INSERT

    Logic/BPV Err Rate:                   1E-9
    Logic/BPV Burst Dur:                SINGLE
    Frame Err:                               1

  AUX - ERR RECEIVE

    Err Thresh:                           1E-7
    Pat Loss Thresh:                      FAST
```

**Figure 4-3**
**DS3 CONTROLS PRINT Printout**

### 4.4.3 Printed Messages

Status, alarm, and note messages are initiated automatically when an important development or condition occurs. The 2-line message format includes the type of message (status, alarm, or note), the message identifying the reported condition, time, date, and the number of times the condition has occurred. Figure 4-4 illustrates a typical sequence of status messages at a test restart. The messages are described in Appendix B.

```
*** NOTE:                  DS3 Test Restart
    MAR 05   10:12:25                  001
*** NOTE:            DS3 New Configuration
    MAR 05   10:12:26                  001
*** STATUS:    DS3 Primary Signal Present
    MAR 05   10:12:27                  001
*** STATUS:  DS3 Primary C-Bit Frame Sync
    MAR 05   10:12:28                  001
*** STATUS:      DS3 Primary Pattern Sync
    MAR 05   10:12:29                  001
*** NOTE:                 DS3 Test Complete
    MAR 05   12:12:30                  001
```

**Figure 4-4**
**Reporting Status Messages**

### Status Messages

Status messages indicate positive conditions in the received signal and relate to the state of the Status LEDs. Status messages start with the header "*** STATUS:".

### Alarm Messages

Alarm messages indicate negative conditions in the received signal and relate to the state of the Alarm LEDs. Alarm messages start with the header "*** ALARM:".

### Note Messages

Note messages indicate conditions affecting the operation of the T-BERD 310. Note messages start with the header "*** NOTE:".

## 4.4.4 Pulse Shape Graph

The pulse shape graph provides a graphic printout of the normalized DS3 pulse shape. The pulse shape graph includes the pulse shape, date, time, power in dBm, level in volts, pulse shape pass/fail indication, pulse width, rise time, fall time, and the selected pulse mask. Figure 4-5 illustrates a typical pulse shape graph.

A graphics compatible printer with parity set to none, e.g., the TTC PR-40A Thermal Printer, and connected to the RS-232 interface is required to print the pulse shape printout. The pulse mask is selected through the PULSE MASK auxiliary function. The pulse shape graph is generated through the GRAPH auxiliary function. If the received signal is not present and the GRAPH auxiliary function is executed, the message "Pulse Shape Unavailable" is printed in place of the graph.

## 4.4.5 Printer Squelch Feature

The automatic printer squelch feature prevents 20 or more errored second *results* printouts or status and alarm *messages* from being generated in a 60-second period. After the 20th printout, the following message is printed indicating that the squelch is on.

```
*** NOTE:                          Squelch On
    MAR 05   12:12:30                     001
```

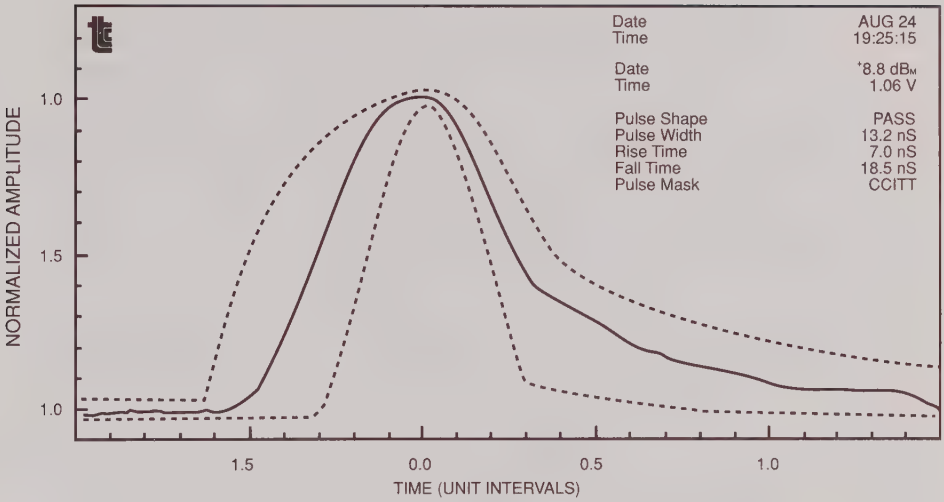



**Figure 4-5**
**DS3 Pulse Shape Graph**

While the squelch feature is on, the T-BERD 310 continues to monitor for errored events, but no automatic errored second *results* printouts or status and alarm *messages* are generated or stored. The timed and manual printouts are not affected by the squelch feature.

The squelch is turned off when five or less errored second *results* printouts or status and alarm *messages* occur in a 60-second period. When this condition is met, the following message is printed indicating that the squelch is off.

```
*** NOTE:                          Squelch Off
    MAR 05   12:12:30                     001
```

A "SQUELCH OFF" *results* printout immediately follows the Squelch Off *message*. Both printouts occur only when the squelch is turned off automatically. A status and alarm message count is also printed. The test results and message counts continue to accumulate when the squelch feature is on.

**NOTE:** The squelch feature is reset by pressing the **RESTART** switch, changing the **PRINT EVENT** switch to OFF, changing the test length, or completing a timed test.

## 4.5 PRINTING WITH THE TTC PR-40A THERMAL PRINTER

Use the following information to configure the T-BERD 310 to print with the TTC PR-40A Thermal Printer. The default RS-232 interface settings match the TTC PR-40A printer default parameters. The easiest way to configure the T-BERD 310 for the PR-40A printer is to press the **RESTART** switch during a power-up. This reconfigures the T-BERD 310 with the factory defaults. The PR-40A factory defaults are listed in Table 4-3. The factory defaults for the PRINT auxiliary group are listed in Table 4-4.

NOTE: Pressing the **RESTART** switch during power-up clears ALL previous T-BERD 310 configurations and reconfigures the T-BERD 310 with the factory defaults.

Table 4-3
PR-40A Printer Default Settings

| Switch | Position | Function | Parameter |
|---|---|---|---|
| **Printer Control DIP Switches** | | | |
| SW1 | OFF | Data Input | Serial |
| SW2 | ON | Auto Line Feed | Enable |
| SW3 | ON | Columns Per Line | 40 |
| SW4 | OFF | Character Selection | Special |
| SW5 | OFF | Zero Format | Ø |
| SW6 | OFF | International Characters | USA |
| SW7 | ON | International Characters | USA |
| SW8 | ON | International Characters | USA |
| **RS-232 DIP Switches** | | | |
| SW1 | ON | Data Bits | 8 (GRAPHICS) |
| SW2 | ON | Parity | DISABLED |
| SW3 | OFF | Parity Selection | EVEN |
| SW4 | OFF | Baud Rate | 2400 |
| SW5 | ON | Baud Rate | 2400 |
| SW6 | OFF | Baud Rate | 2400 |

**Table 4-4**
**T-BERD 310 PRINT Auxiliary Group**

| Auxiliary Function | Factory Default | Description |
|---|---|---|
| **Printer Control** | | |
| INTERVAL | 01:00 | Timed Test Length Interval |
| MODE | Continuous | Printout Mode |
| FORMAT | Normal | Printout Format |
| CUSTOM | All Off | Customized Printout Contents |
| GRAPH | N/A | Print Graph |
| WIDTH | 40 | Printout Line Width |
| **RS-232 Interface Control** | | |
| BAUD RATE | 2400 | RS-232 Interface Baud Rate |
| PARITY | None | RS-232 Interface Parity |
| TERMINATOR | CR | Printout Line Terminator |
| PORT[1] | RS-232 | Printer/Remote Control Interface Selection |

[1] Only appears when the 310-6 IEEE-488 Option is installed.

## 4.6 PRINTING WITH AN IEEE-488 COMPATIBLE PRINTER

Use the following information to configure the T-BERD 310 to generate *results* and *controls* printouts with an IEEE-488 compatible printer. Table 4-5 lists the IEEE-488 printer requirements.

The TERMINATOR auxiliary function must be set for the proper line terminator. The PORT auxiliary function must be set to 488 T/O to select the IEEE-488 interface in talk-only mode.

**Table 4-5**
**IEEE-488 Printer Requirements**

| Function | Parameter |
|---|---|
| Printer Interface | Parallel connector |
| Data Rate | 300 words per second |
| Character Length | 8 bits |
| Line Terminator | CR, LF, or CRLF with EOI |
| Interface Configuration | Talk only or addressable |

# SECTION 5
# REMOTE CONTROL OPERATION

# REMOTE CONTROL OPERATION

## 5.1 INTRODUCTION

This section describes the T-BERD 310 remote control capabilities when using either the RS-232-C interface or the 310-6 IEEE-488 Option interface. The T-BERD 310 can be controlled from either a dumb terminal or computer with either the RS-232-C or IEEE-488 interface.

## 5.2 REMOTE CONTROL SETUP

During normal operation, the T-BERD 310 can be setup and controlled through either an RS-232-compatible or an IEEE-488-compatible remote control device. This section describes the remote control capabilities, auxiliary functions, and setup procedure needed to configure the T-BERD 310 for remote control operation. Table 5-1 lists the interface capabilities available from the T-BERD 310.

### 5.2.1 Auxiliary Functions for Remote Control Setup

Table 5-2 lists the PRINT auxiliary group used to configure the RS-232-C and IEEE-488 interface for remote control operation. The presentation of the T-BERD 310 test *result*, front panel *controls*, and alarm and status *message* printouts sent to the remote control device are described in Section 4.

**Table 5-1**
**T-BERD 310 Remote Control Capabilities**

| Function | Capabilities |
|---|---|
| Remote Interfaces | *RS-232-C* — female 25-pin D connector<br>*IEEE-488* — parallel connector |
| Data Rate | *RS-232-C* — 110, 300, 600, 1200, 2400, 4800, or 9600 b/s<br>*IEEE-488* — 300 words per second |
| Character Length | *RS-232-C* — seven bits with parity or eight bits without parity<br>*IEEE-488* — eight bits |
| Line Terminator | *RS-232-C* — CR, LF, or CRLF<br>*IEEE-488* — CR, LF, or CRLF with EOI |
| Flow Control | *RS-232-C* — DTR/CTS or in-band XON/XOFF supported |
| Parity | *RS-232-C* — odd, even, or none |
| Interface Configuration | *RS-232-C* — DCE<br>*IEEE-488* — addressable |
| Start Bits | *RS-232-C* — one bit |
| Stop Bits | *RS-232-C* — two bits on transmit, one or more on receive |
| Column Width | 40 or 80 |
| Timing | *RS-232-C* — Asynchronous |
| Character Format | ASCII |

**Table 5-2**
**PRINT Auxiliary Function Group Parameters**

| Auxiliary Function | Definition | Selections |
|---|---|---|
| BAUD RATE | RS-232 Interface Baud Rate | 110, 300, 600, 1200, 2400, 4800, or 9600 |
| PARITY[1] | RS-232 Interface Parity | EVEN, ODD, or NONE |
| TERMINATOR[2] | Printout Line Terminator | CR, LF, or CRLF |
| WIDTH | Printout Line Width | 40 or 80 |
| PORT | Printer/Remote Control Interface Port Selection | RS-232, IEEE-488/bus 0 to 30, or 488 T/O |

[1] Word length is controlled by the parity selection, 7 bits for odd or even parity and 8 bits for no parity.
[2] When entering remote control operation, the line terminator defaults to CRLF.

### 5.2.2 RS-232 Interface Remote Control Setup Procedure

The following setup procedure applies to configuring the RS-232 interface for remote control operation.

1. **AUX switch**
   Select the auxiliary functions.

2. **MODE switch**
   Select the PRINT auxiliary group.

3. **Press the PATTERN switch to select the BAUD RATE auxiliary function**
   Press the **RESULTS I Results** switch to select one of the following baud rates: 110, 300, 600, 1200, 2400 (default), 4800, or 9600.

4. **Press the PATTERN switch to select the TERMINATOR auxiliary function**
   Press the **RESULTS I Results** switch to select one of the following line termination characters: CR, LF, or CRLF.

5. **Press the PATTERN switch to select the PARITY auxiliary function**
   Press the **RESULTS I Results** switch to select one of the following parity error detection formats: ODD, EVEN, or NONE. When setting PARITY to ODD or EVEN, the number of data bits equals seven; when PARITY is set to NONE, the number of data bits equals eight.

6. **Go to Section 5.3**
   The section provides connection and operation information for the RS-232 interface.

### 5.2.3 IEEE-488 Interface Remote Control Setup Procedure

The following setup procedure applies to configuring the IEEE-488 interface for remote control operation.

1. **AUX switch**
   Select the auxiliary functions.

2. **MODE switch**
   Select the PRINT auxiliary group.

3. **PATTERN switch**
   Select the PORT auxiliary function.

4. **RESULTS I Results switch**
   Select one of the following ports:

   **488 T/O** — Refer to Section 4 for the IEEE-488 talk-only printer operation.

   **IEEE-488** — Continue with the IEEE-488 addressable setup procedure.

5. **RESULTS II Results switch**
   Select the bus address from 0 to 30. The address should be unique to this instrument.

6. **Press the PATTERN switch to select the TERMINATOR auxiliary function**
   Press the **RESULTS I Results** switch to select one of the following line termination characters: CR, LF, or CRLF.

7. **Go to Section 5.4**
   This section provides connection and operation information for the IEEE-488 interface.

## 5.3 RS-232 REMOTE CONTROL OPERATION

The RS-232-C interface enables the user to remotely control the T-BERD 310 from either a dumb terminal or a computer. The RS-232 interface is a 25-pin female D connector located on the side panel. It is configured to function as Data Communication Equipment (DCE) and it can be connected directly to Data Terminal Equipment (DTE). Connecting to another DCE is possible with the use of an adaptor cable. Auxiliary functions select the baud rate, parity error detection format, and line terminator. Refer to Section 11 for a description of the RS-232 connector pin assignments.

### 5.3.1 Remote Control Modes

When operating in remote control through the RS-232 interface, the T-BERD 310 functions in either an interactive terminal mode or non-interactive remote mode.

The interactive terminal mode is used with either a dumb terminal or an interactive communications package on a personal computer emulating a dumb terminal that is connected directly to the T-BERD 310. The terminal mode (1) provides a prompt string whenever the T-BERD 310 is ready to receive a command, (2) echoes all characters back to the remote device as they are keyed in, and (3) enables access to the test results from the front panel. After entering the terminal mode, the **LOCal** command returns control of the T-BERD 310 to the front panel. The message "232 REMOTE CONTROL" flashes in the MODE/PATTERN window while the T-BERD 310 is in terminal mode.

The non-interactive remote mode allows direct interaction between the remote computer and the T-BERD 310 without interruption from the T-BERD 310. The remote mode does *not* (1) provide a prompt character, (2) echo characters back, and (3) provide front panel access. Commands are entered in the dark and automatic printouts and error messages are sent to the remote computer only upon request. The message "232 REMOTE CONTROL" flashes in the MODE/PATTERN window while the T-BERD 310 is in remote mode. After entering the remote mode, the **LOCal** command returns control of the T-BERD 310 to the front panel.

### 5.3.2 Setup for Remote Control Operation

Before entering remote control through the RS-232 interface, the baud rate, line termination character, and parity must be set to ensure that the T-BERD 310 is properly configured to communicate with the remote control device. The baud rate and parity can only be configured manually from front panel auxiliary functions or the autobaud function.

## Manual Setup for Remote Control Operation

Use the following procedure to manually set the baud rate and parity from the front panel to match the settings of the intended remote control device.

1. **AUX switch**
   Select the auxiliary functions.

2. **MODE switch**
   Select the PRINT auxiliary group.

3. **Press the PATTERN switch to select the BAUD RATE auxiliary function**
   Press the **RESULTS I Results** switch to select one of the following baud rates: 110, 300, 600, 1200, 2400 (default), 4800, or 9600.

4. **Press the PATTERN switch to select the TERMINATOR auxiliary function**
   Press the **RESULTS I Results** switch to select one of the following line termination characters: CR, LF, or CRLF.

5. **Press the PATTERN switch to select the PARITY auxiliary function**
   Press the **RESULTS I Results** switch to select one of the following parity: ODD, EVEN, or NONE. When setting PARITY to ODD or EVEN, the number of data bits equals seven; when PARITY is set to NONE, the number of data bits equals eight.

6. **Terminal or remote operation**
   For terminal mode, at the remote device, press the <. > (period) key and <RETURN>, or enter the **TERminal** command and <RETURN>. The following messages appear when the T-BERD 310 and remote control device enter terminal mode. At the prompt (>), enter the commands.

```
Terminal mode activated.
Enter "HELP" or "?" followed by <RETURN> for help.
>
```

   For remote mode, at the remote device, press the <, > (comma) key and <RETURN>, or enter the **REMote** command and <RETURN>. The following message appears when the T-BERD 310 and remote control device enter remote mode. Commands are entered in the dark.

```
Remote control activated, now in control.
```

## Autobaud Setup for Terminal or Remote Control Operation

The autobaud function allows baud rate, number of data bits, and parity values to be automatically configured. The autobaud function offers possible baud rates of 110, 600, 300, 1200, 2400, 4800, and 9600 and possible parity settings of even, odd, or none. The number of data bits is determined by the parity setting. To establish communication between the remote control unit and the T-BERD 310 through the autobaud function, perform the following procedure from the remote device.

**CAUTION:** The remote device must be capable of sending a BREAK signal to use the autobaud feature.

**NOTE:** The autobaud function must be completed within 30 seconds. If autobaud is not acquired within the 30-second period, the autobaud function is aborted and the message "Autobaud aborted." is printed to the remote device using current communication settings.

1. **Press the <BREAK> key once**
   The following message should appear.

```
Autobaud sequence initiated...
Press <BREAK> again, then hold down the <SPACEBAR> to
enter autobaud mode; or press <SPACEBAR> to abort.
```

2. **Press the <BREAK> key again, then immediately press and hold the <SPACEBAR> for approximately 20 seconds or until the following message appears**

```
Autobaud achieved. Press <ESCAPE> to continue.
```

3. **Press the <ESCAPE> key once**
   The following messages appear when the T-BERD 310 and remote control device are ready to enter remote or terminal mode.

```
Character format determined.
New baud rate now in effect.
```

4. **Terminal or remote operation**
   For terminal mode, at the remote device, press the <. > (period) key or enter the **TERminal** command and <RETURN>. The following messages appear when the T-BERD 310 and remote control device enter terminal mode. At the prompt ( > ), enter the commands.

```
Terminal mode activated.
Enter "HELP" or "?" followed by <RETURN> for help.
>
```

For remote mode, at the remote device, press the <, > (comma) key or enter the REMote command and <RETURN>. The following message appears when the T-BERD 310 and remote control device enter remote mode. Commands are entered in the dark.

```
>Remote control activated, now in control.
```

### 5.3.3 Prompts in Terminal Mode

Three possible prompts can be generated by the T-BERD 310 in the terminal mode: default greater than sign (>), user-defined, and printer-hold plus sign (+) prompts. The default ">" prompt appears when the T-BERD 310 is first placed in terminal mode. A user-defined prompt (up to 32 characters) can be created to replace the default prompt. The user-defined prompt is created by sending the **PROmpt STRing <prompt string>** command (where **<prompt string>** are ASCII characters). This can also be used to create a prompt that identifies the T-BERD 310 attached to the terminal. A user-defined prompt is saved when the T-BERD 310 power is turned OFF. The printer-hold "+" prompt replaces the previous prompt in response to the **HOLd** command. The "+" prompt indicates that the print buffer is not sending printouts to the terminal. Sending the **RELease** command releases the printer hold, which allows printouts to be generated again and returns the prompt to its pre-hold state.

### 5.3.4 Terminating Terminal or Remote Control Operation

To end any remote operating mode and return the T-BERD 310 to local control, send either **LOCal** or "/" followed by a <RETURN>. The T-BERD 310 front panel controls are returned to local control and the "232 REMOTE CONTROL" message is no longer displayed.

**NOTE:** Turning the power OFF also aborts a remote operating mode.

## 5.4 IEEE-488 REMOTE CONTROL OPERATION

The 310-6 IEEE-488 Option interface allows the T-BERD 310 to be connected to an IEEE-488 bus. The IEEE-488 interface and operating mode (addressable or talk-only) is selected through the PORT auxiliary function. In the addressable mode, the T-BERD 310

IEEE-488 bus address (a value between 0 and 30) must be set in the PORT auxiliary function. The T-BERD 310 address allows the controller to designate the T-BERD 310 as a "listen" (receive remote commands) or "talk" (send data) device. The IEEE-488 interface connection is located on the T-BERD 310 side panel above the RS-232-C interface connector. Refer to Section 11 for information on the IEEE-488 connector pin assignments.

### 5.4.1 Remote Control Mode

Prior knowledge of IEEE-488 controller programming and operation is recommended before attempting to operate the T-BERD 310 through the IEEE-488 connector. The following sections describe how to set up and operate the T-BERD 310 from an IEEE-488 controller.

In the IEEE-488 addressable remote control mode, the T-BERD 310 bus address must be set to a value between 0 and 30. This address is used by the controller to determine which device is being addressed.

Unlike an RS-232 connection, the IEEE-488 bus requires that one device on the bus act as a controller. All other devices connected to the bus must act as slaves to that controller. The T-BERD 310 can only act as a slave; another intelligent device must act as the bus controller.

The following steps are typically performed during a remote control input sequence.

1. The controller device addresses the T-BERD 310.
2. The controller sends a valid remote control command.
3. The controller sends a valid remote control line terminator.
4. When the line terminator is received, the T-BERD 310 analyzes the remote command and performs the appropriate action.

When the characters are received, the ASCII null characters are discarded and the remaining characters are saved until the line terminator is received. Upon receipt of the line terminator, the received command is analyzed. If no error is detected, the T-BERD 310 performs the appropriate action and then prepares to receive another command. However, if an error is detected in the command string, an SRQ is asserted and the Least Significant Bit (LSB) of the serial poll register is set. If a response is appropriate, the Most Significant Bit (MSB) is set and an SRQ is asserted.

The line terminator transmitted from the T-BERD 310 can be set to carriage return (CR), linefeed (LF), or both (CRLF). Regardless of the mode or line terminator selection, the EOI signal is asserted with the final character of an entire output.

### 5.4.2 IEEE-488 Programming Hints

Before attempting to read data from a device, it is necessary to know if the device has data to send. The controller has two ways of determining that the T-BERD 310 has data: (1) Bit 7 of the serial poll register (DAV) is set whenever a line of data is available and (2) the T-BERD 310 sends an SRQ to the IEEE-488 controller whenever it has data available. An SRQ can also occur when any remote control error is detected.

The statement used to read data from the T-BERD 310 must be able to terminate the read operation when it encounters the last character of the line. The most foolproof way to detect the last character is by sensing the EOI signal.

### 5.4.3 Remote Control Commands

The following remote control commands *cannot* be used when controlling the T-BERD 310 from an IEEE-488 controller. An error message occurs when using any of these commands.

| | |
|---|---|
| CLS | Clear the terminal screen |
| ECHo | Echo in terminal mode |
| PROmpt | Prompts in terminal mode |
| TERminal | Configure the T-BERD 310 for terminal mode |

## 5.5 ERROR MESSAGES

Error messages are generated by improper command and parameter syntax, parameters out-of-range, or improper configurations. Error messages are formatted with the prefix "*****ERROR**" or "*****WARNING**", the message indicating the problem, and in some cases the improperly entered command or parameter. Error messages are available in all modes. The error and warning messages are described in Appendix B.

## 5.6 REMOTE CONTROL COMMANDS

This section presents the formats and entry sequence for remote control commands, as well as an alphabetical list of all the remote control commands. For each command there is an explanation of the command, references to associated commands, and a brief example of command usage.

Three primary command types are available with the T-BERD 310 remote control facility:

- Switch commands set the T-BERD 310 front-panel switches.
- Auxiliary commands set the T-BERD 310 auxiliary functions.
- Control commands pertain exclusively to remote control operation.

These command sets are described in Section 5.6.2.

### 5.6.1 Command Formats And Entry Sequence

The general format for any remote control command is:

**command_name or**
**command_name [parameter]**

The **command_name** entry specifies the name of the executed command. The **command name** may be abbreviated to the first three characters (e.g., **TERminal**), however some **command_names** require additional characters (e.g., **RESTART**). Multiple word **command names** require a space between each word.

The **[parameter]** entry specifies any parameter(s) associated with the command. A **[parameter]** must be separated from the **command_name** by at least one space. The **[parameter]** may be abbreviated to the first three characters (e.g., **TRAnsmit TIMing [EXTernal]**), however some **[parameters]** require additional characters (e.g., **PULse MASk [CCItt]**). Multiple word **[parameters]** require a space between each word. The on-line **HELP <command>** page displays the required characters in UPPERCASE and the optional characters in lowercase.

Most remote control commands can be used to select a new command state or to display the status of the command. To select a new command state, enter both the **command_name [parameter]** string on the command line. To display the current state of a command, enter the **command_name** only or follow it with a space and a question mark (**?**). Note, however, that some commands (e.g., **CLS**) are "executable only" and have no current or changeable state. The **command_name [parameter]** string should always be followed by a <RETURN>.

Each command sent must have the proper syntax and line terminator before it is accepted as valid. If an invalid command is received, the T-BERD 310 responds by printing an error message. Error messages are listed in Appendix B.

Remote control commands are divided into three basic groups: switch commands, auxiliary function commands, and remote control-only commands.

### Switch Commands

Switch commands control the functions normally associated with the T-BERD 310 front panel switches. Mnemonics represent the first three characters of the switch name or switch position as it appears on the T-BERD 310 front panel. Table 5-3 lists the switch commands that apply to the mainframe switches. The brackets ([ ]) indicate the availability of associated parameters. The parameters associated with each command are described in Section 5.6.2.

**Table 5-3**
**Front-Panel Switch Commands**

| Command | Switch Name | Description |
|---|---|---|
| CONtrols | PRINT CONTROLS | Generate *Controls* Printout |
| DISplay HOLd [ ] | DISPLAY HOLD | Set Display Hold |
| DS1 DROp CHAnnel [ ] | DS1 DROP CHANNEL | Set Dropped DS1/E1 Channel |
| DS1 INSert CHAnnel [ ] | DS1 INSERT CHANNEL | Set DS1 Insert Channel |
| DS3 SOUrce [ ] | DS3 SOURCE | Set DS3 Input Source |
| ERRor INSert BPV [ ] | BPV ERROR INSERT | Execute BPV Insertion |
| ERRor INSert FRAme [ ] | FRAME ERROR INSERT | Execute Frame Error Insertion |
| ERRor INSert LOGic [ ] | LOGIC ERROR INSERT | Execute Logic Error Insertion |
| HIStory RESet | HISTORY RESET | Clear History Alarm LEDs |
| MODe [ ] | MODE | Set Transmit and Receive Operating Mode |
| PATtern [ ] | PATTERN | Set Data Pattern |
| PRInt CONtrols | PRINT CONTROLS | Generate *Controls* Printout |
| PRInt EVEnt [ ] | PRINT EVENT | Set Print Event Function |
| PRInt RESults | PRINT RESULTS | Generate Test *Results* Printout |
| RECeive INPut [ ] | PRIMARY DS3 RECEIVE INPUT | Set Primary DS3 Receive Input Level |
| RES1/2 [ ] | RESULTS I or II | Test Results Display I/II Control |
| RESTART | RESTART | Initiate Test Restart |
| RESULTS | PRINT RESULTS | Generate Test *Results* Printout |
| TESt [ ] | TEST | Set Test Duration |
| TRAnsmit OUTput [ ] | PRIMARY DS3 TRANSMIT OUTPUT | Set DS3 Transmit Output Level |
| TRAnsmit TIMing [ ] | TRANSMIT TIMING | Set DS3 Transmit Timing Source |

## Auxiliary Function Commands

Auxiliary function commands set the parameters of the auxiliary functions. Table 5-4 lists the auxiliary function commands that apply to the mainframe auxiliary functions. The brackets ([ ]) indicate the availability of associated parameters. The parameters associated with each command are described in Section 5.6.2.

**Table 5-4**
**Auxiliary Function Commands**

| Command | Auxiliary Function Name | Description |
|---|---|---|
| BEEp CRIteria [ ] | BEEP CRI | Set Beep Criteria |
| BLUe SIGnal CRIteria [ ] | BLU SIG CRI | Set Blue Signal Detection Criteria |
| DS1 DROp OUT [ ] | DS1 DROP OUT | Set Dropped DS1 Channel Source |
| DS1 LINecode [ ] | DS1 LINECODE | Set DS1 Transmitted Line Coding |
| DS1 LP CODe [ ] | DS1 LP CODE | Set DS1 Loop Code Type |
| ERRor THReshold [ ] | ERROR THR | Set Errored Second Threshold |
| FEAc ALArms [ ] | FEAC ALARMS | FEAC Message Alarm Control |
| FEAc LOOp [ ] | FEAC LOOP | FEAC Message Loopback Control |
| FRAme ERRor [ ] | FRAME ERROR | Set Number of M-Frame Errors Inserted |
| FRaMe LOSs THReshold [ ] | FRM LOSS THR | Set Frame Synchronization Loss Threshold |
| JITter FILter [ ] | JIT FILTER | Set Jitter Bandpass Filter |
| JITter SCAle [ ] | JIT SCALE | Set Jitter Amplitude Scale |
| LOG/bpv BURst [ ] | LOG/BPV BUR | Set Logic/BPV Burst Duration |
| LOG/bpv RT [ ] | LOG/BPV RT | Set Logic/BPV Error Insertion Rate |
| PARity ERRor RT [ ] | PAR ERR RT | Set Parity Error Rate Calculation Criteria |
| PATtern LOSs THReshold [ ] | PAT LOSS THR | Set Pattern Loss Threshold Criteria |
| PGM LPDn [ ] | PGM LPDN | Set Programmable Loop-Down Code |
| PGM LPUp [ ] | PGM LPUP | Set Programmable Loop-Up Code |
| PRInt BAUd RATe | BAUD RATE | Print RS-232 Interface Baud Rate |

Table 5-4
Auxiliary Function Commands (Continued)

| Command | Auxiliary Function Name | Description |
|---|---|---|
| PRInt CUStom [ ] | CUSTOM | Set Custom *Results* Printout |
| PRInt FORmat [ ] | FORMAT | Set Test *Results* Printout Format |
| PRInt GRAph | GRAPH | Print Pulse Shape Graph |
| PRInt INTerval [ ] | INTERVAL | Set Printout Interval |
| PRInt MODe [ ] | MODE | Set Printout Mode |
| PRInt PARity | PARITY | Print RS-232 Interface Parity |
| PRInt TERminator | TERMINATOR | Set Line Terminator |
| PRInt WIDth [ ] | WIDTH | Set Printout and Display Line Width |
| PULse MASk [ ] | PULSE MASK | Set Pulse Shape Mask Specification |
| SET DATe [ ] | SET DATE | Set Calendar Date |
| SET TIMe [ ] | SET TIME | Set Time of Day |
| SONet DS1 CHAnnel | SONET DS1 CH | Set SONET DS1 Channel |
| SONet INPut [ ] | SONET INPUT | Select SONET Interface Input |
| SONet STS ID [ ] | SONET OC-3 INPUT | Set SONET STS Identification |
| STS RX LEVel | STS RX LEVEL | Set SONET STS Receive Input Level |
| TESt LENgth [ ] | TEST LENGTH | Set Timed Test Length |
| TX X-Bit [ ] | TX X-BIT | Set Transmitted X-Bit Pattern |
| USER1 [ ] | USER1 | Set User-Programmable Test Pattern |

## Remote Control-Only Commands

Remote control-only commands have no front panel or auxiliary function equivalent. These commands are used to obtain information from the T-BERD 310 or to modify the remote control/printer protocol. Table 5-5 lists the remote control-only commands. The brackets ([ ]) indicate the availability of associated parameters. The parameters associated with each command are described in Section 5.6.2.

**Table 5-5**
**Remote Control-Only Commands**

| Command | Description |
|---|---|
| ALArms [ ] | Set Alarm Message Printout Control |
| CLEar PRInt BUFfer | Clear Print Buffer |
| CLS | Clear Terminal Screen |
| DISplay [ ] | Set **RESULTS** Switches Control |
| ECHo [ ] | Set Terminal Echo Mode |
| FIRST POWERUP | Execute First Power-Up |
| HELLO | Display Current Software Revision Level |
| HELP [ ] | Display On-Line Help |
| HOLd | Hold All Printer Output |
| LASt ERRor | Print Last Error Message |
| LEDs | Print State of Status and Alarm LEDs |
| LOCAL (/) | Return Control to the Front Panel |
| PRInt [ ] | Print Selected Test Result |
| PROmpt [ ] | Set Terminal Mode Prompt |
| RELease | Release All Printer Output |
| REMote (,) | Enter Remote Control Mode |
| TERminal (.) | Enter Terminal Mode |

## Input Sequence

A remote command consists of an ASCII character string followed by either a CR, LF, or CRLF. When specifying a remote control command, the following rules apply:

1. Commands can be entered either in uppercase, lowercase, or mixed case characters.

2. Spaces must be inserted between the **command_name(s)** and **[parameter(s)]**.

3. Entering a <CTRL> <C> (Control C) or a <CTRL> <X> (Control X) before issuing a <RETURN> cancels the input line. (<CTRL> <C> also aborts all printing.)

4. Entering a <CTRL> <H> (Control H) or a <BACKSPACE> erases the last character entered. This is available for the RS-232 interface only.

5. Up to 20 previously entered commands can be recalled by using <ESCAPE> or <CTRL>\>. When the number of previously sent commands exceeds 20, the earliest command entries are overwritten. This is available for the RS-232 interface only.

After receiving a line terminator, the T-BERD 310 analyzes the data in its input buffer. It checks the data for parity, overrun, framing, overflow, and syntax errors as it is received. If any error is detected, the appropriate error message is returned through the interface. If no error is detected, the command is executed and the appropriate response generated.

If the **ECHo** command is enabled, the entered character string is echoed back to the controller. If the **PROmpt** command is enabled, the default prompt (">") or a user-defined prompt is used to indicate that the previous command has been processed and that the T-BERD 310 is ready to accept another command.

NOTE: The **TERminal** command automatically enables **ECHo** and **PROmpt** when entering the terminal mode. With either the **PROmpt** or **ECHo** command enabled, any characters used to cancel a line are echoed to the remote control unit. The prompt and echo features are only applicable for the RS-232 interface.

### Output Sequence

The following rules apply for output sequences:

1. All remote control output sequences have a higher priority than the print buffer.

2. The **HOLd** command suspends the printer output until the **RELease** command is sent. When sending the **HOLd** command and the prompt is ON, the prompt character automatically changes to a "+" to indicate that data is waiting to be printed. After sending the **RELease** command and if the prompt is ON, the default prompt (>) or the user-defined prompt is returned. Note that the remote control output is not affected by **HOLd**.

3. <CTRL> <S> suspends all output. Sending a <CTRL> <Q> (Control Q), releases the printer output suspended by the <CTRL> <S>. These control characters only apply for RS-232 controllers.

4. Sending a <CTRL> <C> (Control C) clears the entire print buffer.

## 5.6.2 T-BERD 310 Remote Control Commands

The T-BERD 310 remote control commands are described in alphabetical order.

## ALArms

ALArms

Set Alarm Message Printout Control

**ALArms [?|ON|OFF]**

This command sets or prints the alarm message printout function. The command controls whether alarm, status, and note messages are printed when a print event is selected with the **PRInt EVEnt** command.

**ALArms ?** :Print the alarm message printout status.

**ALArms ON** :Enable the alarm message printout control. Alarm, status, and note messages are printed when a print event is selected. When the **PRInt EVEnt** command is **OFF**, the **ALArms ON** command has no effect.

**ALArms OFF** :Disable the alarm message printout control. Alarm, status, and note messages are not printed when a print event is selected.

EXAMPLE:

```
>ALA OFF          :Disable the alarm message printout control.
>ALA              :Print the current alarm message printout status.
OFF               :The alarm message printout control is disabled.
>
```

BEEp CRIteria

Set Beep Criteria

**BEEp CRIteria [?|{ALL|ERRor EVEnt|PATtern SYNc|THReshold ERRor SEConds (ON|OFF)}]**

This command sets or prints the beep criteria for specific events.

| | |
|---|---|
| **BEEp CRIteria ?** | :Print the current beep criteria status. |
| **BEEp CRIteria ALL [ON\|OFF]** | :Enable/Disable all of the beep criterion. |
| **BEEp CRIteria ERRor EVEnt [ON\|OFF]** | :Enable/Disable the T-BERD 310 to beep on an error event. |
| **BEEp CRIteria PATtern SYNc [ON\|OFF]** | :Enable/Disable the T-BERD 310 to beep on pattern synchronization. |
| **BEEp CRIteria THReshold ERRor SEConds [ON\|OFF]** | :Enable/Disable the T-BERD 310 to beep on an errored second. |

EXAMPLE:

| | |
|---|---|
| **>BEE CRI ALL OFF** | :Disable all of the beep criterion. |
| **>BEE CRI** | :Print the current beep criteria status. |
| OFF | :All of the beep criterion are disabled. |
| **>** | |

## BLUe SIGnal CRIteria

BLUe SIGnal CRIteria

Set Blue Signal Detection Criteria

**BLUe SIGnal CRIteria [?|1010|STUck C-Bit]**

This command sets or prints the Blue Signal detection criteria.

| | |
|---|---|
| **BLUe SIGnal CRIteria ?** | :Print the Blue Signal detection criteria. |
| **BLUe SIGnal CRIteria 1010** | :Set the Blue Signal detection to the 1010 criteria. |
| **BLUe SIGnal CRIteria STUck C-Bit** | :Set the Blue Signal detection to the stuck C-bit criteria. |

EXAMPLE:

| | |
|---|---|
| **>BLU SIG CRI** | :Print the Blue Signal detection criteria. |
| 1010 | :The Blue Signal detection criteria is set to 1010. |
| > | |

**CLEar PRInt BUFfer** **CLEar PRInt BUFfer**

Clear Print Buffer

**CLEar PRInt BUFfer** :This command clears all printouts from the print buffer.

**CLS** **CLS**

Clear Terminal Screen

**CLS** :This command clears the terminal screen with 30 carriage returns.

**CONtrols** **CONtrols**

Generate *Controls* Printout

**CONtrols** :This command generates a *controls* printout of the T-BERD 310 front panel configuration. The **PRInt CONtrols** command performs the same function.

See also: **PRInt CONtrols**

EXAMPLE:

**> CON** :Print the T-BERD 310 front-panel configuration.

```
            DS3 CONTROLS PRINT
- - - - - - - - - - - - - - - - - - - - - -
AUG 14                          13:46:09
- - - - - - - - - - - - - - - - - - - - - -

  DS3 PANEL SETTINGS
  - - - - - - - - - - - - - - - - - - -

    Mode:                    MUXED C-BIT
    Pattern:                   T1D4 3/24
    DS3 Source:                EXTERNAL
    Test Type:                    TIMED
                      .
                      .
                      .
    Pulse Mask:                    NONE

  AUX - SONET
  - - - - - - - - - - - - - - - - - - -

    SONET Input:                   STS-1
    SONET STS Number:                1
    DS1 Drop Out:                SONET
    SONET DS1 Channel:              28
    STS Rx Level:                  DSX

             END OF PRINTOUT


>
```

**DISplay** **DISplay**

Set **RESULTS** Switches Control

**DISplay [?|LOCal|REMote]**

This command sets or prints the **RESULTS** switches control on the T-BERD 310 and 310-1.

| | |
|---|---|
| **DISplay ?** | :Print the **RESULTS** switches control status. |
| **DISplay LOCal** | :Set the **RESULTS** switches for local front-panel and remote control operation. |
| **DISplay REMote** | :Set the **RESULTS** switches for remote control operation only. |

EXAMPLE:

| | |
|---|---|
| **> DIS ?** | :Print the **RESULTS** switches control status. |
| LOCal | :The **RESULTS** switches are active at the front panel. |
| **> DIS REM** | :Disable the **RESULTS** switches. |
| **>** | |

## DISplay HOLd

DISplay HOLd

Set Display Hold

**DISplay HOLd [?|ON|OFF]**

This command sets or prints the display hold.

| | |
|---|---|
| **DISplay HOLd ?** | :Print the display hold status. |
| **DISplay HOLd ON** | :Activate the display hold function. The results and Status and Alarm LEDs are frozen. |
| **DISplay HOLd OFF** | :Disable the display hold function. The results and the Status and Alarm LEDs are released and updated. |

NOTE: While the **DISplay HOLd** command is ON, updated results can be checked with the **RES1/2** command.

See also: **PRInt** and **RESUlts**

EXAMPLE:

| | |
|---|---|
| **> DIS HOL ?** | :Print the display hold setting. |
| OFF | :The display hold is disabled. |
| **>** | |

## DS1 DROp CHAnnel

DS1 DROp CHAnnel

Set Dropped DS1/E1 Channel

**DS1 DROp CHAnnel [?|{1|2 to 28}|{E1|E2 to E21}]**

This command sets or prints the dropped DS1/E1 channel.

| | |
|---|---|
| **DS1 DROp CHAnnel ?** | :Print the dropped DS1/E1 channel. |
| **DS1 DROp CHAnnel [1\|2 to 28]** | :Select the DS1 channel to be dropped. DS1 channels are entered with numbers from 1 to 28. |
| **DS1 DROp CHAnnel [E1\|E2 to E21]** | :Select the E1 channel to be dropped. E1 channels are entered with numbers from E1 to E21. An E1 channel can only be dropped when the 310-2 E1 Drop Option is installed. |

EXAMPLE:

| | |
|---|---|
| **> DS1 DRO CHA ?** | :Print the dropped DS1 channel status. |
| 10 | :Channel 10 is the currently dropped DS1 channel. |
| **> DS1 DRO CHA 5** | :Set the dropped DS1 channel to none. |
| **>** | |

## DS1 DROp OUT

DS1 DROp OUT

Set Dropped DS1 Channel Source

**DS1 DROp OUT [?|DS3|SONet]**

This command sets or prints the dropped DS1 channel source (DS3 or SONET) for the side-panel DS1 DROP jack. This command is only functional when a SONET drop option is installed.

| | |
|---|---|
| **DS1 DROp OUT ?** | :Print the current dropped DS1 channel source status. |
| **DS1 DROp OUT DS3** | :Set the dropped DS1 channel source to the received DS3 signal. The DS1 signal is dropped from the PRIMARY DS3 RECEIVE INPUT jack. |
| **DS1 DROp OUT SONet** | :Set the dropped DS1 channel source to the received SONET signal. The DS1 signal is dropped from the side-panel STS-1 RECEIVE or OC-1/3 RECEIVE (optional) connection. |

EXAMPLE:

| | |
|---|---|
| **> DS1 DRO OUT ?** | :Print the current dropped DS1 channel source status. |
| SONET | :The dropped DS1 channel source is set to SONET. |
| **> DS1 DRO OUT DS3** | :Set the dropped DS1 channel source to DS3. |
| **>** | |

 DS1 INSert CHAnnel

Set DS1 Insert Channel

**DS1 INSert CHAnnel [?|{1|2 to 28}|ALL|NONe]**

This command sets or prints the inserted DS1 channel. The command is also used to insert a DS1 channel into the secondary DS3 signal when the DS1 INSERT mode is selected.

**DS1 INSert CHAnnel ?** :Print the inserted DS1 channel.

**DS1 INSert CHAnnel [1|2 to 28]** :Select the DS1 channel into which the DS1 signal is to be inserted.

**DS1 INSert CHAnnel ALL** :Insert the DS1 signal into all DS1 channels. This command only applies to MUXED M13 and MUXED C-BIT modes.

**DS1 INSert CHAnnel NONe** :In the MUXED modes, this command inserts an All Ones pattern into all the DS1 channels. In the DS1 INSERT mode (310-3 DS1 Insert Option), the command allows the entire secondary DS3 signal to pass unaffected and prevents the DS1 signal from being inserted.

See also: **MODe**

## DS1 LINecode

DS1 LINecode

Set DS1 Transmitted Line Coding

**DS1 LINecode [?|AMI|B8Zs]**

This command sets or prints the DS1 line coding for the side-panel DS1 DROP output jack.

| | |
|---|---|
| **DS1 LINecode ?** | :Print the DS1 line code. |
| **DS1 LINecode AMI** | :Set the DS1 line code to AMI. |
| **DS1 LINecode B8Zs** | :Set the DS1 line code to B8ZS. |

EXAMPLE:

| | |
|---|---|
| **> DS1 LIN ?** | :Print the current DS1 line code status. |
| AMI | :The DS1 line code is set to AMI. |
| **> DS1 LIN B8Z** | :Set the DS1 line code to B8ZS. |

## DS1 LP CODe

DS1 LP CODe

Set DS1 Loop Code Type

**DS1 LP CODe [?|CSU|FAC1|FAC2|PGM]**

This command sets or prints the transmitted DS1 loop code type. The command only applies when operating in the MUXED M13 or MUXED C-BIT mode and the T1D4 or T1ESF LPUP or LPDN pattern is selected.

| | |
|---|---|
| **DS1 LP CODe ?** | :Print the DS1 loop code. |
| **DS1 LP CODe CSU** | :Set the DS1 loop code type to CSU. The loop-up code is 10000 and the loop-down code is 100. |
| **DS1 LP CODe FAC1** | :Set the DS1 loop code type to Facility 1. The loop-up code is 1100 and the loop-down code is 1110. |
| **DS1 LP CODe FAC2** | :Set the DS1 loop code type to Facility 2. The loop-up code is 11000 and the loop-down code is 11100. |
| **DS1 LP CODe PGM** | :Set the loop code type to Programmable. Use the **PGM LPDn** and **PGM LPUp** commands to program the loop codes. |

See also: **MODe, PGM LPUp**, and **PGM LPDn**

EXAMPLE:

| | |
|---|---|
| **> DS1 LP COD CSU** | :Set the DS1 loop code to CSU. |
| **> MOD MUX M13** | :Set the mode to MUXED M13. |
| **> PAT T1D4 LPU** | :Set the pattern to T1D4 LPUP. |
| **> DS1 INS CHA 5** | :Set the DS1 insert channel to 5. |
| **>** | |

## DS3 SOUrce

DS3 SOUrce

Set DS3 Input Source

**DS3 SOUrce [?|EXTernal|SONet]**

This command sets or prints the DS3 input source. This command is only functional when a SONET drop option is installed.

| | |
|---|---|
| **DS3 SOUrce ?** | :Print the DS3 input source status. |
| **DS3 SOUrce EXTernal** | :Set the DS3 input source to the PRIMARY DS3 RECEIVE INPUT jack. |
| **DS3 SOUrce SONet** | :Set the DS3 input source to the side-panel STS-1 RECEIVE or OC-1/3 RECEIVE (optional) connection. |

EXAMPLE:

| | |
|---|---|
| **> DS3 SOU ?** | :Print the current DS3 input source status. |
| SONET | :The DS3 input source is set to SONET. |
| **> DS3 SOU EXT** | :Set the DS3 input source to EXTERNAL. |
| **>** | |

ECHo

ECHo

Set Terminal Echo Mode

**ECHo [?|ON|OFF]**

This command sets or prints the terminal echo mode.

**ECHo ?** :Print the terminal echo mode.

**ECHo ON** :Enable the terminal echo mode. All characters entered from a terminal are echoed back from the T-BERD 310. The command is automatically enabled in terminal mode (see **TERminal** command).

**ECHo OFF** :Disable the terminal echo mode. All characters entered from a terminal are *not* echoed back from the T-BERD 310. The command is automatically disabled in remote mode (see **REMote** command).

See also: **REMote** and **TERminal**

ERRor INSert BPV

Execute BPV Insertion

**ERRor INSert BPV [?|OFF|BURst|RATe|SINgle]**

This command sets or prints the BPV insertion setting.

| | |
|---|---|
| **ERRor INSert BPV ?** | :Print the BPV insertion setting. |
| **ERRor INSert BPV OFF** | :Disable the continuous BPV insertion. |
| **ERRor INSert BPV BURst** | :Insert a burst of BPVs. Set the burst length with the **LOG/bpv BURst** command. Set the insertion rate with the **LOG/bpv RT** command. |
| **ERRor INSert BPV RATe** | :Insert continuous BPVs. Set the insertion rate with the **LOG/bpv RT** command. |
| **ERRor INSert BPV SINgle** | :Insert a single BPV. |

See also: **LOG/bpv BURst** and **LOG/bpv RT**

EXAMPLE:

| | |
|---|---|
| **> LOG BUR 0.5** | :Set the Logic/BPV burst duration for 0.5 seconds. |
| **> LOG RT 1E-3** | :Set the Logic/BPV error insertion rate to 1E-3 ($10^{-3}$). |
| **> ERR INS BPV BUR** | :Send a burst of BPVs for 0.5 seconds at a rate of 1E-3. |
| **> PRI VIOLATIONS** | :Print the VIOLATIONS result. |
| 4434 | :4434 BPVs were detected. |

ERRor INSert FRAme

Execute Frame Error Insertion

**ERRor INSert FRAme [?|OFF|MULtiple|CONtinuous|SINgle]**

This command sets or prints the frame error insertion setting.

| | |
|---|---|
| **ERRor INSert FRAme ?** | :Print the frame error insertion setting. |
| **ERRor INSert FRAme OFF** | :Stop all frame error insertion. |
| **ERRor INSert FRAme MULtiple** | :Insert multiple frame errors into one M-frame. Set the number of frame errors with the **FRAme ERRor** command. |
| **ERRor INSert FRAme CONtinuous** | :Insert multiple frame errors continuously. Set the number of frame errors with the **FRAme ERRor** command. |
| **ERRor INSert FRAme SINgle** | :Insert a single frame error. |

See also: **FRAme ERRor**

EXAMPLE:

| | |
|---|---|
| **> FRA ERR 2** | :Set the number of M-frame errors to two. |
| **> ERR INS FRA CON** | :Send two frame errors per M-frame continuously. |
| **> ERR INS FRA OFF** | :Stop the continuous frame error insertion. |
| **> PRI FRM ERRORS** | :Print the results of the FRM ERRORS result. |
| 2345 | :2345 frame errors were detected. |

**ERRor INSert LOGic** **ERRor INSert LOGic**

Execute Logic Error Insertion

**ERRor INSert LOGic [?|OFF|BURst|RATe|SINgle]**

This command sets or prints the logic error insertion setting.

| | |
|---|---|
| **ERRor INSert LOGic ?** | :Print the logic error insertion setting. |
| **ERRor INSert LOGic OFF** | :Disable the continuous logic error insertion. |
| **ERRor INSert LOGic BURst** | :Insert a burst of logic errors. Set the burst duration with the **LOG/bpv BURst** command. Set the insertion rate with the **LOG/bpv RT** command. |
| **ERRor INSert LOGic RATe** | :Insert continuous logic errors. Set the insertion rate with the **LOG/bpv RT** command. |
| **ERRor INSert LOGic SINgle** | :Insert a single logic error. |

See also: **LOG/bpv BURst** and **LOG/bpv RT**

EXAMPLE:

| | |
|---|---|
| **> LOG BUR 0.5** | :Set the Logic/BPV burst duration for 0.5 seconds. |
| **> LOG RT 1E-6** | :Set the Logic/BPV error insertion rate to 1E-6 ($10^{-6}$). |
| **> ERR INS LOG BUR** | :Send a burst of logic errors for 0.5 seconds at a rate of 1E-6. |
| **> PRI BIT ERRORS** | :Print the results of the BIT ERRORS result. |
| 345 | :345 logic errors were detected. |

**ERRor THReshold** **ERRor THReshold**

Set Errored Second Threshold

**ERRor THReshold [?|{1E-2|1E-3 to 1E-8}]**

This command sets or prints the errored second threshold for the BIT THR ES, FRM THR ES, and BPV THR ES results.

**ERRor THReshold ?** :Print the current errored second threshold status.

**ERRor THReshold [1E-2|1E-3 to 1E-8]** :Set the errored second threshold from 1E-2 to 1E-8.

FEAC Message Alarm Control

**FEAc ALArms [?|<parameter>|STOp]**

This command sets, sends, halts, or prints the Far-End Alarm and Control (FEAC) alarms. The alarm message is transmitted for one second.

| | |
|---|---|
| **FEAc ALArms ?** | :Print the FEAC alarm status. |
| **FEAc ALArms STOp** | :Halt the selected FEAC alarm message. |
| **FEAc ALArms DS3 EQUip FAIl (SA)** | :Select and send the DS3 Equipment Failure, Service Affecting (Type 1 equipment failure) alarm message. |
| **FEAc ALArms DS3 LOS/hber** | :Select and send the DS3 Loss-of-Signal/ High Bit Error Ratio alarm message. |
| **FEAc ALArms DS3 OUT OF FRAme** | :Select and send the DS3 Out-of-Frame, Loss of DS3 Frame Synchronization alarm message. |
| **FEAc ALArms DS3 AIS RECeived** | :Select and send the DS3 Alarm Indication Signal Received alarm message. |
| **FEAc ALArms DS3 IDLe RECeived** | :Select and send the DS3 Idle Signal Received alarm message. |
| **FEAc ALArms DS3 EQUip FAIl (NSA)** | :Select and send the DS3 Equipment Failure, Non-Service Affecting (Type 2 equipment failure) alarm message. |
| **FEAc ALArms COMm EQUip FAIl (NSA)** | :Select and send the Common Equipment Failure, Non-Service Affecting (Type 2 equipment failure) alarm message. |
| **FEAc ALArms MULt DS1 LOS/hber** | :Select and send the Multiple DS1 Loss-of-Signal/High Bit Error Ratio alarm message. |
| **FEAc ALArms DS1 EQUip FAIl (SA)** | :Select and send the DS1 Equipment Failure, Service Affecting (Type 1 equipment failure) alarm message. |

FEAC Message Alarm Control (Continued)

**FEAc ALArms SINgle DS1 LOS/hber** :Select and send the Single DS1 Loss-of-Signal/ High Bit Error Ratio alarm message.

**FEAc ALArms DS1 EQUip FAIl (NSA)** :Select and send the DS1 Equipment Failure, Non-Service Affecting (Type 2 equipment failure) alarm message.

See also: **FEAc LOOp**

EXAMPLE:

**>FEA ALA ?** :Print the FEAC alarm status.
DS1 EQUIP FAIL (SA) :The DS1 Equipment Failure, Non-Service Affecting (Type 2 equipment failure) alarm message is selected.

**>FEA ALA DS3 IDL REC** :Select and send the DS3 Idle Signal Received alarm message.

**>**

## FEAc LOOp

FEAc LOOp

FEAC Message Loopback Control

**FEAc LOOp [?|{UP|DOWn} DS3 LINe|{UP|DOWn} ALL DS1s|{UP|DOWn} DS1 {1|2 to 28}]**

This command sets, loops up, loops down, or prints the FEAC message loop codes.

| | |
|---|---|
| **FEAc LOOp ?** | :Print the FEAC message loop code status. |
| **FEAc LOOp UP DS3 LINe** | :Select and send the DS3 line loop-up code. |
| **FEAc LOOp DOWn DS3 LINe** | :Select and send the DS3 line loop-down code. |
| **FEAc LOOp UP ALL DS1s** | :Select and send the DS1 line loop-up code to loop up all the low-speed DS1 channels. |
| **FEAc LOOp DOWn ALL DS1s** | :Select and send the DS1 line loop-down code to loop down all the low-speed DS1 channels. |
| **FEAc LOOp UP DS1 [1\|2 to 28]** | :Select and send the DS1 line loop-up code to loop up the indicated low-speed DS1 channel. |
| **FEAc LOOp DOWn DS1 [1\|2 to 28]** | :Select and send the DS1 line loop-down code to loop down the indicated low-speed DS1 channel. |

See also: **FEAc ALArms**

EXAMPLE:

| | |
|---|---|
| **>FEA LOO ?** | :Print the FEAC loopback status. |
| DS1 Channel 5 | :The DS1 Channel 5 loop code is selected. |
| **>FEA LOO UP ALL DS1** | :Select and send the DS1 line loop-up code to loop up all the low-speed DS1 channels. |
| **>** | |

## FIRST POWERUP

FIRST POWERUP

Execute First Power-Up

**FIRST POWERUP** :This command reinitializes the T-BERD 310 (and 310-1) to its factory default settings. It also takes the instrument out of remote control. Use the **DEVICE CLEAR** command to reset the T-BERD 310 to its configuration at power-up.

## FRAme ERRor

FRAme ERRor

Set Number of M-Frame Errors Inserted

**FRAme ERRor [?|1|2]**

This command sets or prints the number of frame errors per M-frame inserted when the **ERRor INSert FRAme** command is used.

**FRAme ERRor ?** :Print the current number of frame errors per M-frame to be inserted.

**FRAme ERRor [1|2]** :Set the number of frame errors per M-frame from 1 to 2.

See also: **ERRor INSert FRAme**

**FRaMe LOSs THReshold** **FRaMe LOSs THReshold**

Set Frame Synchronization Loss Threshold

**FRAme LOSs THReshold [?|3 out of 15|6 out of 15]**

This command sets or prints the frame synchronization loss threshold.

| | |
|---|---|
| **FRM LOSs THReshold ?** | :Print the frame loss threshold. |
| **FRM LOSs THReshold 3 out of 15** | :Set the threshold to 3 frame errors out of 15 framing bits received. |
| **FRM LOSs THReshold 6 out of 15** | :Set the threshold to 6 frame errors out of 15 framing bits received. |

EXAMPLE:

| | |
|---|---|
| **> FRM LOS THR ?** | :Print the frame loss threshold. |
| 3 OUT OF 15 | :The frame loss threshold is 3 OUT OF 15. |
| **> FRM LOS THR 6** | :Set the frame loss threshold to 6 OUT OF 15. |

HELLO HELLO

Display Current Software Revision Level

**HELLO** :Print the current software revision level and installed options of the T-BERD 310. This information is useful to verify the T-BERD 310 configuration when you have called TTC for assistance.

EXAMPLE:

**> HELLO**

```
Software version ?.10 09/08/91

Installed boards/options and module codes:

   PROCESSOR     BOARD: Module code = 00
   IEEE-488     OPTION: Installed
   TRANSMITTER   BOARD: Module code = 00
   RECEIVER      BOARD: Module code = 00
   FRAMING       BOARD: Module code = 00
   E1 DROP      OPTION: Installed
   DS1 BERTS     BOARD: Module code = 00
   ZBTSI        OPTION: Not installed
   DS1 INSERT    BOARD: Module code = 00
   SONET DROP    BOARD: Module code = 00
   OPTICAL I/F OPTION: Installed
   JITTER        BOARD: Not installed
   DS3 USER I/F BOARD: Module code = 00
   DS1 USER I/F BOARD: Module code = 00


>
```

## HELP

HELP

Display On-Line Help

**HELP (?) [!|{0|MISc}|{1|FROnt}|{2|AUX1}|{3|AUX2}|{4|MAInframe}|{5|232/488}|<command-name>]**

This command prints the on-line help pages for the T-BERD 310.

**HELP (?)** :Use either **HELP** or **?** to print the introduction to the T-BERD 310 help pages. The help page identifies the command syntax for entering commands and a list of the available help page commands. The "**?**" can be used in place of **HELP** in the following commands. Use either the page number (e.g., **? 4**) or the page name (e.g., **? FRO**) to select the required help page.

**HELP !** :List all the available T-BERD 310 remote control commands.

**HELP [0|MISc]** :List the T-BERD 310 (and 310-1) miscellaneous remote control commands.

**HELP [1|FROnt]** :List the T-BERD 310 front-panel remote control commands.

**HELP [2|AUX1]** :List page 1 of the T-BERD 310 auxiliary function remote control commands.

**HELP [3|AUX2]** :List page 2 of the T-BERD 310 auxiliary function remote control commands.

**HELP [4|MAInframe]** :List the remote control commands that affect the operation of the T-BERD 310 (and 310-1).

**HELP [5|232/488]** :List the remote control commands that affect the operation of the RS-232 and 310-6 IEEE-488 Option interfaces.

**HELP <command-name>** :Describe the **<command-name>** and any parameters in detail.

See also: **@HELp**

EXAMPLE:

**> ? RESTART** :Print the **RESTART** help page.
Restart the current test.
**>**

**HIStory RESet** **HIStory RESet**

Clear History Alarm LEDs

**HIStory RESet** :Clear any illuminated Primary (and Secondary) History Alarm LED.

EXAMPLE:

**> LED** :Print the state of the Status and Alarm LEDs.

```
          - alarms -
primary                    secondary
ON   OFF  signal    loss   OFF  OFF
ON   OFF  frame     loss   OFF  OFF
ON   OFF  ds2 frame loss   OFF  OFF
OFF  OFF  pattern   loss        |
OFF  OFF  blue      (AIS)  OFF  OFF
ON   OFF  yellow           OFF  OFF
OFF  OFF  far-end   alarm  OFF  OFF
OFF  OFF  sonet     loss
ON        power     loss
  |_________ history _________|
```

```
          - status -
primary                    secondary
  ON    signal    present   OFF
  ON    frame     sync      OFF
  ON    c-bit     frame     OFF
  OFF   idle      present   OFF
  ON    ds2 frame sync      OFF
  OFF   pattern   sync
  OFF   sonet     present
```

**> HIS RES** :Reset the History Alarm LEDs.
**> LED** :Print the state of the Status and Alarm LEDs.

```
          - alarms -
primary                    secondary
OFF  OFF  signal    loss   OFF  OFF
OFF  OFF  frame     loss   OFF  OFF
OFF  OFF  ds2 frame loss   OFF  OFF
OFF  OFF  pattern   loss        |
OFF  OFF  blue      (AIS)  OFF  OFF
OFF  OFF  yellow           OFF  OFF
OFF  OFF  far-end   alarm  OFF  OFF
OFF  OFF  sonet     loss
OFF       power     loss
  |_________ history _________|
```

```
          - status -
primary                    secondary
  ON    signal    present   OFF
  ON    frame     sync      OFF
  ON    c-bit     frame     OFF
  OFF   idle      present   OFF
  ON    ds2 frame sync      OFF
  OFF   pattern   sync
  OFF   sonet     present
```

>

**HOLd** **HOLd**

Hold All Printer Output

**HOLd** :This command places a temporary hold on the following print buffer outputs: *result* prints, *controls* prints, and alarm, status, and note *messages*. When the command is executed, the prompt changes from the ">" (greater than) or user-defined prompt to a "+" (plus). The "+" indicates that the print buffer is temporarily on hold. When the "+" prompt appears, command responses (except for **CONtrols** and **RESUlts**), help pages, and syntax error messages continue to be generated. The *results*, *controls*, and *message* printouts are generated and stored in the print buffer. Use the **RELease** command to release the print buffer and print all stored printouts. Turning the power off and on performs the same function as the **RELease** command.

See also: **RELease** and **PROmpt**

EXAMPLE:

**> HOL** :Hold all printer output.
**+ CON** :Print the DS3 controls print. No response to command.
**+ REL** :Release hold on printer output. All stored printouts are generated.

```
- - - - - - - - - - - - - - - - - - - - - - - -
            DS3 CONTROLS PRINT
- - - - - - - - - - - - - - - - - - - - - - - -
AUG 14                              13:50:25
- - - - - - - - - - - - - - - - - - - - - - - -
  DS3 PANEL SETTINGS
  - - - - - - - - - - - - - - - - - - -
    Mode:                      MUXED C-BIT
    Pattern:                     T1D4 3/24
    DS3 Source:                   EXTERNAL
                        .
                        .
                        .

>
```

**JITter FILter** **JITter FILter**

Set Jitter Bandpass Filter

**JITter FILter [?|WIDeband|HIGhband|AUTo]**

This command sets or prints the jitter bandpass function of the 310-5 DS3 Jitter Option.

| | |
|---|---|
| **JITter FILter ?** | :Print the jitter bandpass function status. |
| **JITter FILter WIDeband** | :Select the wideband filter (10 Hz to 400 kHz). |
| **JITter FILter HIGhband** | :Select the highband filter (30 kHz to 400 kHz). |
| **JITter FILter AUTo** | :Select the automatic bandpass filter function. |

See also: **JITter SCAle**

EXAMPLE:

| | |
|---|---|
| **>JIT FIL ?** | :Print the jitter bandpass filter function status. |
| WIDEBAND | :The wideband filter is selected. |
| **>JIT FIL AUT** | :Set the jitter filter function to auto mode. |
| **>** | |

**JITter SCAle** **JITter SCAle**

Set Jitter Amplitude Scale

**JITter SCAle [?|2 ui pk-pk|5 ui pk-pk|20 ui pk-pk|AUTo]**

This command sets or prints the jitter amplitude scale of the 310-5 DS3 Jitter Option.

| | |
|---|---|
| **JITter SCAle ?** | :Print the jitter amplitude scale status. |
| **JITter SCAle 2 ui pk-pk** | :Set the scale to the 2 UIp-p range. |
| **JITter SCAle 5 ui pk-pk** | :Set the scale to the 5 UIp-p range. |
| **JITter SCAle 20 ui pk-pk** | :Set the scale to the 20 UIp-p range. |
| **JITter SCAle AUTo** | :Set the scale for autoranging. |

See also: **JITter FILter**

EXAMPLE:

| | |
|---|---|
| **>JIT SCA** | :Print the jitter amplitude scale status. |
| AUTO | :The scale is set for autoranging. |
| **>JIT SCA 5** | :Set the scale to the 5 UIp-p range. |
| **>** | |

**LASt ERRor** **LASt ERRor**

Print Last Error Message

**LASt ERRor** :This command prints and clears the last error message generated.

EXAMPLE:

**> LAS ERR**

```
*** ERROR: Remote Control cannot modify this setting.
```
**> LAS ERR**

```
No Error.
```

## LEDs

LEDs

Print State of Status and Alarm LEDs

**LEDs** :This command prints the state of the Status and Alarm LEDs.

EXAMPLE:

**> LED**

```
                  - alarms -
primary                          secondary
OFF   OFF   signal     loss   OFF   OFF
OFF   OFF   frame      loss   OFF   OFF
OFF   OFF   ds2 frame  loss   OFF   OFF
OFF   OFF   pattern    loss          |
OFF   OFF   blue       (AIS)  OFF   OFF
OFF   OFF   yellow            OFF   OFF
OFF   OFF   far-end    alarm  OFF   OFF
OFF   OFF   sonet      loss          |
OFF         power      loss          |
  |_____________ history _____________|
```

```
                  - status -
primary                          secondary
   ON     signal     present     OFF
   ON     frame      sync        OFF
   ON     c-bit      frame       OFF
   OFF    idle       present     OFF
   ON     ds2 frame  sync        OFF
   OFF    pattern    sync
   OFF    sonet      present
```

**>**

LOCal

Return Control to the Front Panel

**LOCal (/)**

:This command returns the T-BERD 310 (and 310-1) to local front panel control from terminal or remote mode. The message "232 REMOTE CONTROL" stops flashing in the MODE/PATTERN window. The T-BERD 310 always monitors the remote control interface for commands from the remote control device. When any command is received, the T-BERD 310 goes into remote mode.

See also: **TERminal** and **REMote**

**LOG/bpv BURst** **LOG/bpv BURst**

Set Logic/BPV Burst Duration

**LOG/bpv BURst [?|{0.025|0.050 to 5.0}|{25|50 to 5000}|SINgle]**

This command sets or prints the logic error or BPV insertion burst duration.

| | |
|---|---|
| **LOG/bpv BURst ?** | :Print the current burst duration. |
| **LOG/bpv BURst [0.025\|0.050 to 5.0]** | :Set the burst duration from 0.025 to 1.0 second in 0.025 second steps and from 1.0 to 5.0 seconds in 0.100 second steps. For whole seconds (1 to 5), drop the zero. |
| **LOG/bpv BURst [25\|50 to 5000]** | :Set the burst duration from 25 to 1000 ms in 25 ms steps and from 1000 to 5000 ms in 100 ms steps. |
| **LOG/bpv BURst SINgle** | :Set the burst duration for a single logic error or BPV. |

See also: **ERRor INSert BPV** and **ERRor INSert LOGic**

EXAMPLE:

| | |
|---|---|
| **> LOG BUR 0.5** | :Set the Logic/BPV burst duration for 0.5 seconds. |
| **> LOG RT 1E-3** | :Set the Logic/BPV error insertion rate to 1E-3 ($10^{-3}$). |
| **> ERR INS BPV BUR** | :Send a burst of BPVs for 0.5 seconds at a rate of 1E-3. |
| **> PRI VIOLATIONS** | :Print the results of the VIOLATIONS result. |
| 4434 | :4434 BPVs were detected. |

**LOG/bpv RT** **LOG/bpv RT**

Set Logic/BPV Error Insertion Rate

**LOG/bpv RT [?|{1E-2|1E-3 to 1E-9}]**

This command sets or prints the logic error or BPV insertion rate.

**LOG/bpv RT ?** :Print the insertion rate.

**LOG/bpv RT [1E-2|1E-3 to 1E-9]** :Set the insertion rate from 1E-2 to 1E-9.

See also: **ERRor INSert BPV** and **ERRor INSert LOGic**

EXAMPLE:

**> LOG RT 1E-3** :Set the Logic/BPV error insertion rate to 1E-3 ($10^{-3}$).

**> ERR INS BPV RT** :Send continuous BPVs at a rate of 1E-3.
**> PRI VIOLATIONS** :Print the VIOLATIONS result.
4434 :4434 BPVs were detected.

**MODe** **MODe**

Set Transmit and Receive Operating Mode

**MODe [?|AUTo|C-Bit|INSert DS1|M13|MUXed C-Bit|MUXed M13|THRu|UNFramed]**

This command sets or prints the transmit and receive operating mode.

| | |
|---|---|
| **MODe ?** | :Print the operating mode. |
| **MODe AUTo** | :Select the automatic configure frame and pattern mode. |
| **MODe C-Bit** | :Select the DS3 C-bit parity frame formatted mode. |
| **MODe DS1 INSert** | :Select the DS1 INSERT mode. |
| **MODe M13** | :Select the DS3 M13 frame formatted mode. |
| **MODe MUXed C-Bit** | :Select the demultiplexable DS3 C-bit frame formatted mode. |
| **MODe MUXed M13** | :Select the demultiplexable DS3 M13 frame formatted mode. |
| **MODe THRu** | :Select the through mode. |
| **MODe UNFramed** | :Select the unframed DS3 mode. |

See also: **PATtern**

## PARity ERRor RT

Set Parity Error Rate Calculation Criteria

**PARity ERRor RT [?|BIT ERRor|BLOck ERRor]**

This command sets or prints the PARITY error rate calculation criteria.

| | |
|---|---|
| **PARity ERRor RT ?** | :Print the error rate calculation criteria. |
| **PARity ERRor RT BIT ERRor** | :Set the error rate calculation criteria to BIT error mode. |
| **PARity ERRor RT BLOck ERRor** | :Set the error rate calculation criteria to BLOCK error mode. |

**PATtern** **PATtern**

Set Data Pattern

**PATtern [?|2^15-1|2^20-1|2^23-1|1010|1100|1111|T1D4 1:7|T1D4 3/24|
T1D4 1004hz|T1D4 LPDn|T1D4 LPUp|T1D4 QRSs|T1Esf 1:7|T1Esf 3/24|
T1Esf 1004hz|T1Esf LPDn|T1Esf LPUp|T1Esf QRSs|EXTernal DS1|
INTernal DS1|USER1]**

This command sets or prints the transmitted test pattern. The following patterns are divided into three groups: non-channelized patterns, channelized patterns, and DS1 insert patterns. The test pattern does not need to be set when either the AUTO or THRU mode is selected.

**PATtern ?** :Print the pattern.

***Non-channelized Test Patterns*** — The following patterns only apply to the M13, UNFRAMED, and C-BIT modes.

**PATtern 2^15-1** :Select the 32,767-bit pseudorandom pattern.

**PATtern 2^20-1** :Select the 1,048,575-bit pseudorandom pattern.

**PATtern 2^23-1** :Select the 8,388,607-bit pseudorandom pattern.

**PATtern 1010** :Select the fixed framed or unframed alternating marks (1) and spaces (0) pattern.

**PATtern 1100** :Select the fixed framed or unframed repeating two marks (1) and two spaces (0) pattern.

**PATtern 1111** :Select the fixed framed or unframed all marks (1) pattern.

**PATtern USER1** :Select the fixed 3- to 24-bit user-programmable test pattern. Use the **USER1** command to set the test pattern.

***Channelized Test Patterns*** — The following patterns only apply to the MUXED M13 and MUXED C-BIT modes.

**PATtern T1D4 1:7** :Select the T1 D4 formatted 1:7 pattern

**PATtern T1D4 3/24** :Select the T1 D4 formatted 3 IN 24 pattern.

Set Data Pattern (Continued)

**PATtern T1D4 1004hz** :Select the T1 D4 formatted 1004 Hz tone.

**PATtern T1D4 LPDn** :Select the T1 D4 formatted loop-down code pattern.

**PATtern T1D4 LPUp** :Select the T1 D4 formatted loop-up code pattern.

**PATtern T1D4 QRSs** :Select the T1 D4 formatted QRSS pattern.

**PATtern T1Esf 1:7** :Select the T1 ESF formatted 1:7 pattern.

**PATtern T1Esf 3/24** :Select the T1 ESF formatted 3 IN 24 pattern.

**PATtern T1Esf 1004hz** :Select the T1 ESF formatted 1004 Hz tone.

**PATtern T1Esf LPDn** :Select the T1 ESF formatted loop-down code pattern.

**PATtern T1Esf LPUp** :Select the T1 ESF formatted loop-up code pattern.

**PATtern T1Esf QRSs** :Select the T1 ESF formatted QRSS pattern.

***DS1 Insert Source*** — The following selections only apply to the DS1 INSERT mode when the 310-3 DS1 Insert Option is installed.

**PATtern EXTernal DS1** :Select the side-panel DS1 RECEIVE jack signal as the DS1 signal source to be inserted into the secondary DS3 signal.

**PATtern INTernal DS1** :Select the 310-1 as the DS1 signal source to be inserted into the secondary DS3 signal.

See also: **MODe**

 PATtern LOSs THReshold

Set Pattern Loss Threshold Criteria

**PATtern LOSs THReshold [?|FASt|SLOw]**

This command sets or prints the pattern loss threshold criteria.

**PATtern LOSs THReshold ?** :Print the pattern loss threshold criteria.

**PATtern LOSs THReshold FASt** :Set the pattern loss threshold to FAST. Pattern loss occurs when 1024 or more bit errors are counted in 32,767 bits received.

**PATtern LOSs THReshold SLOw** :Set the pattern loss threshold to SLOW. Pattern loss occurs when 250,000 or more bit errors are counted in 1,000,000 bits received.

**PGM LPDn** **PGM LPDn**

Set Programmable Loop-Down Code

**PGM LPDn [?|{000|001 to 11111111}]**

This command sets or prints the DS1 3- to 8-bit programmable loop-down code. The command only applies when operating in the MUXED M13 or MUXED C-BIT mode and the T1D4 LPDN or T1ESF LPDN pattern is selected. Set the **DS1 LP CODe** command to **PGM** to select the loop code. The pattern is transmitted from left to right.

**PGM LPDn ?** :Print the loop-down code.

**PGM LPDn [000|001 to 11111111]** :Set the loop-down code in a binary format from 000 to 11111111.

See also: **DS1 LP CODe** and **PATtern**

PGM LPUp

Set Programmable Loop-Up Code

**PGM LPUp [?|000|001 to 11111111]**

This command sets or prints the DS1 3- to 8-bit programmable loop-up code. The command only applies when operating in the MUXED M13 or MUXED C-BIT mode and the T1D4 LPUP or T1ESF LPUP pattern is selected. Set the **DS1 LP CODe** command to **PGM** to select the loop code. The pattern is transmitted from left to right.

| | |
|---|---|
| **PGM LPUp ?** | :Print the loop-up code. |
| **PGM LPUp [000\|001 to 11111111]** | :Set the loop-up code in a binary format from 000 to 11111111. |

See also: **DS1 LP CODe** and **PATtern**

PRInt PRInt

Print Selected Test Result

**PRInt [<result name>|SECondary <result name>]**

This command prints the selected T-BERD 310 test result value.

**PRInt <result name>** :Print the primary DS3 test result value.

**PRInt SECondary <result name>** :Print the secondary DS3 test result value. This only applies when the 310-3 DS1 Insert Option is installed.

NOTE: The **<result name>** must be keyed in as indicated.

**PRIMARY DS3 <result names>**

*LOGIC Category*

| | |
|---|---|
| AV BIT ERT | Average Bit Error Rate |
| BIT %EFS | Bit, Percentage of Error-Free Seconds |
| BIT ERR RT | Bit Error Rate |
| BIT ERR SEC | Bit Errored Seconds |
| BIT ERRORS | Bit Errors |
| BIT THR ES | Bit, Threshold Errored Seconds |
| SLIPS | Pattern Slips |
| SYNC ES | Synchronous Errored Seconds |
| SYNC L SEC | Synchronization Loss Seconds |

*LOGIC Category, 310-10 G.821 Results Option*

| | |
|---|---|
| %AVAIL SEC | % Available Seconds |
| %DEG MIN | % Degraded Minutes |
| %SEVERR SEC | % Severely Errored Seconds |
| AVAIL SEC | Available Seconds |
| CSES | Consecutive Severely Errored Seconds |
| DEG MIN | Degraded Minutes |
| SEV ERR SEC | Severely Errored Seconds |
| UNAVAIL SEC | Unavailable Seconds |

*BPV Category*

| | |
|---|---|
| AV BPV ERT | Average BPV Error Rate |
| BPV %EFS | BPV, Percentage of Error-Free Seconds |
| BPV ERR RT | BPV Error Rate |
| BPV ERR SEC | BPV Errored Seconds |
| BPV THR ES | BPV Threshold Errored Seconds |
| VIOLATIONS | Bipolar Violations |

**PRInt** **PRInt**

Print Selected Test Result (Continued)

| | |
|---|---|
| *PARITY Category* | |
| AV C-BIT ERT | Average C-Bit Error Rate |
| AV FEBE RT | Average Far-End Block Error Rate |
| AV PAR ERT | Average Parity (P-Bit) Error Rate |
| C-BIT %EFS | C-Bit, Percentage of Error-Free Seconds |
| C-BIT ERR RT | C-Bit Error Rate |
| C-BIT ERRORS | C-Bit Errors |
| C-BIT TYPE A | C-Bit Errored Seconds, Type A |
| C-BIT TYPE B | C-Bit Errored Seconds, Type B |
| C-BIT TYPE C | C-Bit Errored Seconds, Type C |
| FEBE %EFS | Far-End Block Error, Percentage of Error-Free Seconds |
| FEBE | Far-end Block Errors |
| FEBE RT | Far-end Block Error Rate |
| FEBE TYPE A | Far-End Block Error, Errored Seconds, Type A |
| FEBE TYPE B | Far-End Block Error, Errored Seconds, Type B |
| FEBE TYPE C | Far-End Block Error, Errored Seconds, Type C |
| PAR %EFS | Parity (P-Bit), Percentage of Error-Free Seconds |
| PAR ERR RT | Parity (P-Bit) Error Rate |
| PAR ERR SEC | Parity (P-Bit) Errored Seconds |
| PAR ERRORS | Parity (P-Bit) Errors |
| *FRAME Category* | |
| AV FRM ERT | Average Frame Error Rate |
| DS2 AV F ERT | DS2 Average Frame Error Rate |
| DS2 FRM ERR | DS2 Frame Errors |
| DS2 FRM ERT | DS2 Frame Error Rate |
| FEOOF SEC | Far-End Out-of-Frame Seconds |
| FRM %EFS | Frame, Percentage of Error-Free Seconds |
| FRM ERR RT | Frame Error Rate |
| FRM ERR SEC | Frame Errored Seconds |
| FRM ERRORS | Frame Errors |
| FRM LOSS CT | DS3 Frame Loss Count |
| FRM THR ES | Frame Threshold Errored Seconds |
| NEOOF SEC | Near-End Out-of-Frame Seconds |
| RX X-BIT | Received X-Bit |
| TX X-BIT | Transmitted X-Bit |
| *SIGNAL Category* | |
| FALL TIME | DS3 Pulse Fall Time |
| LEVEL | Received Signal Level, Vp |
| POWER | Received Signal Power Measurement |
| PULSE SHAPE | DS3 Pulse Shape Status |

Print Selected Test Result (Continued)

| | |
|---|---|
| PULSE WIDTH | DS3 Pulse Width |
| RISE TIME | DS3 Pulse Rise Time |
| RX FREQ | Received Frequency |
| SIG L SEC | Signal Loss Seconds |
| TX FREQ | Transmitted Frequency |
| *SIGNAL Category, 310-5 DS3 Jitter Option* | |
| HB JITTER | Highband Jitter |
| MAX HB JIT | Maximum Highband Jitter |
| MAX WB JIT | Maximum Wideband Jitter |
| WB JITTER | Wideband Jitter |
| *SONET Category, 310-4/A SONET Drop Option* | |
| APS COUNTS | Automatic Protection Switch (APS) Counts |
| FRM WORD ERR | Frame Word Errors |
| LINE BIP ERR | Line Bit Interleave Parity (BIP) Errors |
| LINE BIP ES | Line BIP Errored Seconds |
| LINE BIP SES | Line BIP Severely Errored Seconds |
| PATH BIP ERR | Path Bit Interleave Parity (BIP) Errors |
| PATH BIP ES | Path BIP Errored Seconds |
| PATH BIP SES | Path BIP Severely Errored Seconds |
| POINTER JUST | Pointer Justification Counts |
| SECT BIP ERR | Section Bit Interleave Parity (BIP) Errors |
| SECT BIP ES | Section BIP Errored Seconds |
| SECT BIP SES | Section BIP Severely Errored Seconds |
| SEV ERR FRM | Severely Errored Framing Seconds |
| SONET FREQ | SONET Frequency |
| *TIME Category* | |
| DATE | Current Date |
| ELAPSED TIME | Elapsed Time |
| TEST LENGTH | Timed Test Length |
| TIME | Current Time of Day |
| TIME LEFT | Timed Test Time Left |

**SECONDARY DS3 <result names>**

| | |
|---|---|
| *BPV Category* | |
| AV BPV ERT | Average BPV Error Rate |
| BPV %EFS | BPV, Percentage of Error-Free Seconds |
| BPV ERR RT | BPV Error Rate |
| BPV ERR SEC | BPV Errored Seconds |
| VIOLATIONS | Bipolar Violations |

**PRInt** **PRInt**

Print Selected Test Result (Continued)

| | |
|---|---|
| *PARITY Category* | |
| AV C-BIT ERT | Average C-bit Parity Error Rate |
| AV FEBE RT | Average Far-End Block Error Rate |
| AV PAR ERT | Average Parity (P-bit) Error Rate |
| C-BIT %EFS | C-bit Parity, Percentage of Error-Free Seconds |
| C-BIT ERR RT | C-bit Parity Error Rate |
| C-BIT ERRORS | C-bit Parity Errors |
| C-BIT TYPE A | C-bit Parity Errored Seconds, Type A |
| C-BIT TYPE B | C-bit Parity Errored Seconds, Type B |
| C-BIT TYPE C | C-bit Parity Errored Seconds, Type C |
| FEBE %EFS | Far-End Block Error, Percentage of Error-Free Seconds |
| FEBE | Far-End Block Errors |
| FEBE RT | Far-End Block Error Rate |
| FEBE TYPE A | Far-End Block Errored Seconds, Type A |
| FEBE TYPE B | Far-End Block Errored Seconds, Type B |
| FEBE TYPE C | Far-End Errored Seconds, Type C |
| PAR %EFS | Parity (P-bit), Percentage of Error-Free Seconds |
| PAR ERR RT | Parity (P-bit) Error Rate |
| PAR ERR SEC | Parity (P-bit) Errored Seconds |
| PAR ERRORS | Parity (P-bit) Errors |
| *FRAME Category* | |
| AV FRM ERT | Average Frame Error Rate |
| FRM %EFS | Frame, Percentage of Error-Free Seconds |
| FRM ERR RT | Frame Error Rate |
| FRM ERR SEC | Frame Errored Seconds |
| FRM ERRORS | Frame Errors |
| *SIGNAL Category* | |
| RX FREQ | Received Frequency in Hertz |

EXAMPLE:

**> PRI DATE** :Print the date.
AUG 09
**> PRI MAX HB JIT** :Print the Maximum Highband Jitter result.
2.45
**> PRI FRM %EFS** :Print the Frame, Percentage of Error-Free Seconds result.

100.00
>

**PRInt BAUd RATe** **PRInt BAUd RATe**

Print RS-232 Interface Baud Rate

**PRInt BAUd RATe** :Prints the RS-232 interface baud rate. The baud rate can only be changed from the front panel (BAUD RATE auxiliary function).

**PRInt CONtrols** **PRInt CONtrols**

Generate *Controls* Printout

**PRInt CONtrols** :This command prints the front-panel controls and auxiliary function configuration for the T-BERD 310. The **CONtrols** command performs the same function.

See also: **CONtrols**

EXAMPLE:

**> PRI CON** :Print the front-panel controls and auxiliary function configuration.

```
            DS3 CONTROLS PRINT
- - - - - - - - - - - - - - - - - - - -
JUN 22                          08:18:17
- - - - - - - - - - - - - - - - - - - -

  DS3 PANEL SETTINGS

  - - - - - - - - - - - - - - - - - - -
    Mode:                           M13
    Pattern:                    2^23-1
    DS3 Source:               EXTERNAL
    Test Type:              CONTINUOUS
    TX Timing:                INTERNAL
    DS1 Insert Channel:     NO STATUS
    DS1 Drop Channel:              28
                        .
                        .
                        .

>
```

**PRInt CUStom** **PRInt CUStom**

Set Custom Results Printout

**PRInt CUStom [?|{ALL|<result name>|SECondary <result name>(ON|OFF)}]**

This command sets or prints the selected test results for a custom *results* printout. Select the custom *results* printout with the **PRInt FORmat** command. The custom *results* printout is generated with either the **PRInt RESults** or **RESUlts** command. Refer to the **PRInt** command for a list of **<result names>.**

**PRInt CUStom ?** :Print the selected test results for the custom *results* printout.

**PRInt CUStom <result name> ON** :Set the **<result name>** to ON. A **<result name>** that is set to ON is printed in the custom *results* printout.

**PRInt CUStom <result name> OFF** :Set the **<result name>** to OFF. A **<result name>** that is set to OFF is not printed in the custom *results* printout.

**PRInt CUStom ALL ON** :Set ALL the **<result names>** and Status and Alarm LEDs to ON. The custom *results* printout lists all the test results.

**PRInt CUStom ALL OFF** :Set ALL the **<result names>** and Status and Alarm LEDs to OFF. The custom *results* printout header is generated without the results.

**PRInt CUStom SECondary <result name> ON** :Set the secondary DS3 **<result name>** to ON. A **<result name>** that is set to ON is printed in the custom *results* printout.

**PRInt CUStom SECondary <result name> OFF** :Set the secondary DS3 **<result name>** to OFF. A **<result name>** that is set to OFF is not printed in the custom *results* printout.

See also: **PRInt FORmat, PRInt RESults,** and **RESUlts**

**PRInt EVEnt** **PRInt EVEnt**

Set Print Event Function

**PRInt EVEnt [?|OFF|15 MINutes|30 MINutes|ERRored SECond|TESt END|TIMed]**

This command sets or prints the print event setting.

| | |
|---|---|
| **PRInt EVEnt ?** | :Print the print event setting. |
| **PRInt EVEnt OFF** | :Set the print event to OFF. |
| **PRInt EVEnt 15 MINutes** | :Set the print event to 15 MINUTES. |
| **PRInt EVEnt 30 MINutes** | :Set the print event to 30 MINUTES. |
| **PRInt EVEnt ERRored SECond** | :Set the print event to ERRORED SECOND. |
| **PRInt EVEnt TESt END** | :Set the print event to TEST END. The **TESt** command must be set to **TIMed**. |
| **PRInt EVEnt TIMed** | :Set the print event function to TIMED. Set the **PRInt INTerval** command. |

See also: **TESt** and **PRInt INTerval**

PRint FORmat

Set Test *Results* Printout Format

**PRint FORmat [?|CUStom|NORmal|SUMmary]**

This command sets or prints the test *results* printout format for the T-BERD 310 and 310-1. Generate the selected *results* printout with either the **PRint RESults** or **RESUlts** command.

| | |
|---|---|
| **PRint FORmat ?** | :Print the test *results* printout format. |
| **PRint FORmat CUStom** | :Set the test *results* printout format to CUSTOM. Select the custom *results* with the **PRint CUStom** command. |
| **PRint FORmat NORmal** | :Set the test *results* printout format to NORMAL. The normal *results* printout lists the state of all Status and Alarm LEDs and test results. |
| **PRint FORmat SUMmary** | :Set the test *results* printout format to SUMMARY. The summary *results* printout lists the state of all Status and Alarm LEDs and the test results that appear in the SUMMARY category. |

See also: **PRint CUStom, PRint RESults,** and **RESUlts**

 PRInt GRAph

Print Pulse Shape Graph

**PRInt GRAph** :This command generates a pulse shape graph. A graphics compatible terminal must be used to generate the graph.

See also: **PRInt MASk**

**PRInt INTerval** **PRInt INTerval**

Set Timed Print Event Interval

**PRInt INTerval [?|<hh:mm>]**

This command sets or prints the amount of time between printouts when the **PRInt EVEnt** command is set to **TIMed**.

**PRInt INTerval ?** :Print the timed print interval.

**PRInt INTerval <hh:mm>** :Set the print interval from 00:01 to 24:59.

See also: **PRInt EVEnt**

EXAMPLE:

**> PRI INT 01:30** :Print a results printout every 1 hour and 30 minutes.

**> PRI EVE TIM** :Set the print event to TIMED.

```
>
- - - - - - - - - - - - - - - - - - - - - - -
         NORMAL RESULTS PRINT
- - - - - - - - - - - - - - - - - - - - - - -
Timed - 01:30:00                      JUN 22
Continuous                          08:46:01
- - - - - - - - - - - - - - - - - - - - - - -
          DS3 TEST RESULTS
   - - - - - - - - - - - - - - - - - -

  PRIMARY DS3 STATUS
  - - - - - - - - - - - - - - - - - -
    Signal Present:                   ON
    Frame Sync:                       ON
    C-bit Frame:                      OFF
    Idle Present:                     OFF
    DS2 Frame Sync:                   OFF
    Pattern Sync:                     ON
                      .
                      .
                      .
```

**> PRI EVE OFF** :Set the print event to OFF.

## PRInt MODe

PRInt MODe

Set Printout Mode

**PRInt MODe [?|CONtinuous|DELta]**

This command sets or prints the mode of the *results* printout. The command selects how the test results are accumulated when the **PRInt EVEnt** command is set to **TIMed**, **ERRored SECond**, **15 MINutes**, or **30 MINutes**.

**PRInt MODe ?** :Print the print mode.

**PRInt MODe CONtinuous** :Set the print mode to CONTINUOUS. Test results are accumulated for the duration of the test.

**PRInt MODe DELta** :Set the print mode to DELTA. Test results are accumulated between the occurrence of the selected print event. As the printout is sent to the print buffer, all test result counters are zeroed out.

See also: **PRInt EVEnt** and **RESUlts**

## PRInt PARity

PRInt PARity

Print RS-232 Interface Parity

**PRInt PARity** :Prints the RS-232 interface parity. The parity can only be changed from the front panel (PARITY auxiliary function).

**PRInt RESults** **PRInt RESults**

Generate Test Results Printout

**PRInt RESults** :This command generates a T-BERD 310 test *results* printout.

See also: **RESUlts**

EXAMPLE:

**> PRI RES** :Print the test results.

```
- - - - - - - - - - - - - - - - - - - -
        NORMAL RESULTS PRINT
- - - - - - - - - - - - - - - - - - - -
Manual                              JUN 22
Continuous                        08:46:01
- - - - - - - - - - - - - - - - - - - -
          DS3 TEST RESULTS
  - - - - - - - - - - - - - - - - -

  PRIMARY DS3 STATUS

    Signal Present:                 ON
    Frame Sync:                     ON
    C-bit Frame:                    OFF
    Idle Present:                   OFF
    DS2 Frame Sync:                 OFF
    Pattern Sync:                   ON
                      .
                      .
                      .

>
```

## PRInt TERminator

PRInt TERminator

Set Line Terminator

**PRInt TERminator [?|CR|LF|CRLf]**

This command sets or prints the line terminator.

| | |
|---|---|
| **PRInt TERminator ?** | :Print the line terminator. |
| **PRInt TERminator CR** | :Set the line terminator to a carriage return. |
| **PRInt TERminator LF** | :Set the line terminator to a linefeed. |
| **PRInt TERminator CRLf** | :Set the line terminator to a carriage return and linefeed. |

## PRInt WIDth

PRInt WIDth

Set Printout and Display Line Width

**PRInt WIDth [?|40|80]**

This command sets or prints the line width of printouts. The command does not affect commands that do not generate printouts, e.g., help pages.

| | |
|---|---|
| **PRInt WIDth ?** | :Print the line width. |
| **PRInt WIDth 40** | :Set the print line width to 40 characters per line. |
| **PRInt WIDth 80** | :Set the print line width to 80 characters per line. |

**PROmpt** **PROmpt**

Set Terminal Mode Prompt

**PROmpt [?|ON|OFF|STRing <prompt string>]**

This command sets or prints the terminal mode prompt. A "**>**" (greater than sign) indicates the T-BERD 310 is ready to accept a command. The "**>**" is the prompt default. A "**+**" (plus sign) indicates when the T-BERD 310 is ready to accept a command and the **HOLd** command has been executed. A user-defined prompt can also be created.

| | |
|---|---|
| **PROmpt ?** | :Print the terminal mode prompt. |
| **PROmpt ON** | :Turn the prompt ON. |
| **PROmpt OFF** | :Turn the prompt OFF. |
| **PROmpt STRing <prompt string>** | :Create a user-defined prompt. The **<prompt string>** can be 32 characters in length. The **<prompt string>** is stored in NOVRAM. The prompt can be removed by creating a new prompt or executing the **FIRST POWERUP** command. |

See also: **HOLd** and **RELease**

EXAMPLE:

| | |
|---|---|
| **> PRO STR T-BERD 310 SITE 5>** | :Create the prompt "T-BERD 310 SITE 5**>**". |
| **T-BERD 310 SITE 5> \|** | :Prompt identifies the T-BERD 310. The "\|" is the cursor. |
| **T-BERD 310 SITE 5> PRO STR >** | :Create the prompt "**>**". This removes the old prompt. |
| **>** | :New prompt. |

## PULse MASk

Set Pulse Shape Mask Specification

**PULse MASk [?|ANSi|CCItt]**

This command sets or prints the selected DS3 pulse shape mask. The selected mask is generated along with the normalized pulse shape in the pulse shape graph printout. The SIGNAL category PULSE SHAPE result is affected by the selected pulse mask.

| | |
|---|---|
| **PULse MASk ?** | :Print the pulse mask setting. |
| **PULse MASk NONe** | :Set the pulse mask to NONE. The pulse shape continues to be analyzed but is not compared to a pulse mask. |
| **PULse MASk ANSi** | :Set the pulse mask to the ANSI T1.102-1991 pulse mask specification. |
| **PULse MASk CCItt** | :Set the pulse mask to the proposed CCITT G.703 pulse mask recommendation. |

See also: **PRInt GRAph**

**RECeive INPut** **RECeive INPut**

Set Primary DS3 Receive Input Level

**RECeive INPut [?|HIGh|DSX|LOW]**

This command sets or prints the PRIMARY DS3 RECEIVE INPUT jack receive input level.

| | |
|---|---|
| **RECeive INPut ?** | :Print the receive input level. |
| **RECeive INPut HIGh** | :Set the receive input to HIGH. |
| **RECeive INPut DSX** | :Set the receive input to DSX. |
| **RECeive INPut LOW** | :Set the receive input to LOW. |

**RELease** **RELease**

Release All Printer Output

**RELease** :This command disables the **HOLd** command and releases the print buffer output. The prompt changes from **+** to **>** when the buffer hold is released. Any printouts generated during the hold are printed.

See also: **HOLd** and **PROmpt**

**> HOL** :Hold all printer output.
**+ CON** :Print the DS3 controls print. No response to command.
**+ REL** :Release hold on printer output.

```
- - - - - - - - - - - - - - - - - - - - -
           DS3 CONTROLS PRINT
- - - - - - - - - - - - - - - - - - - - -
JUN 22                          08:19:17
- - - - - - - - - - - - - - - - - - - - -

  DS3 PANEL SETTINGS
   - - - - - - - - - - - - - - - - - -
    Mode:                          M13
    Pattern:                    2^23-1
    DS3 Source:               EXTERNAL
    Test Type:              CONTINUOUS
    TX Timing:                INTERNAL
    DS1 Insert Channel:     NO STATUS
    DS1 Drop Channel:              28

>
```

**REMote** **REMote**

Enter Remote Control Mode

**REMote ( , )** :This command places the T-BERD 310 in the remote control mode from either the local or terminal mode. The command disables the following functions: **PROmpt**, **ECHo**, and front-panel switches (except **RESULTS** switches). The message "232 REMOTE CONTROL" flashes in the MODE/PATTERN window. The comma (,) can be used in place of **REMote**.

See also: **LOCal**, **TERminal**, **PROmpt**, and **ECHo**

EXAMPLE 1 (local to remote mode):

:The T-BERD 310 (and 310-1) is in local mode. Enter the **REM** command. The command is not echoed from the T-BERD 310.

```
Remote Control activated, now in control
```

:The T-BERD 310 responds with the above message and is placed in remote control mode. The **PROmpt**, **ECHo**, and front-panel switches (except **RESULTS** switches) are disabled. "232 REMOTE CONTROL" flashes in the MODE/PATTERN window.

:Enter **PRI TIM**.

12:34:23 :The T-BERD 310 responds with the current time.

EXAMPLE 2 (terminal to remote mode):

**> rem** :The T-BERD 310 (and 310-1) is in local mode. Enter the **REM** command. The command is not echoed from the T-BERD 310.

```
Terminal mode deactivated.
```

**REMote** **REMote**

Enter Remote Control Mode (Continued)

:The T-BERD 310 responds with the above message and is in remote control mode. The **PROmpt**, **ECHo**, and front-panel switches (except **RESULTS** switches) are disabled. "232 REMOTE CONTROL" flashes in the MODE/ PATTERN window.

:Enter **PRI TIM**.

12:34:23

:The T-BERD 310 responds with the current time.

## RES1/2 RES1/2

Test Results Display I/II Control

**RES1/2 [?|<result name>|SECondary <result name>]**

These commands set or print the test results being displayed in the RESULTS I and RESULTS II windows. Refer to the **PRInt** command for a list of valid **<result names>.**

| | |
|---|---|
| **RES1/2 ?** | :Print the test result displayed in either the RESULTS I or RESULTS II window. |
| **RES1/2 <result name>** | :Display the primary DS3 **<result name>** in either the RESULTS I or RESULTS II window. |
| **RES1/2 SECondary <result name>** | :Display the secondary DS3 **<result name>** in either the RESULTS I or RESULTS II window. This only applies when the 310-3 DS1 Insert Option is installed. |

See also: **PRInt**

EXAMPLE:

| | |
|---|---|
| **> RES1** | :Print displayed result. |
| BIT ERRORS | :The BIT ERRORS result is displayed in the RESULTS I window. |
| **> RES2 VIOLATIONS** | :Display the VIOLATIONS result in the RESULTS II window. |
| **>** | |

## RESTART

RESTART

Initiate Test Restart

**RESTART** :This command restarts the T-BERD 310 test.

**RESUlts** **RESUlts**

Generate Test Results Printout

**RESUlts** :This command generates a T-BERD 310 test *results* printout.

See also: **PRInt RESults** and **PRInt EVEnt**

EXAMPLE:

**> RESU** :Print the test results.

```
- - - - - - - - - - - - - - - - - - - - -
        NORMAL RESULTS PRINT
- - - - - - - - - - - - - - - - - - - - -
Manual                              JUN 22
Continuous                        08:46:01
- - - - - - - - - - - - - - - - - - - - -
           DS3 TEST RESULTS

   - - - - - - - - - - - - - - - - -

  PRIMARY DS3 STATUS

     Signal Present:                ON
     Frame Sync:                    ON
     C-bit Frame:                   OFF
     Idle Present:                  OFF
     DS2 Frame Sync:                OFF
     Pattern Sync:                  ON
                        .
                        .
                        .
>
```

## SET DATe

SET DATe

Set Calendar Date

**SET DATe [?|<mmm dd>]**

This command sets or prints the calendar date.

| | |
|---|---|
| **SET DATe ?** | :Print the calendar date. |
| **SET DATe <mmm dd>** | :Set the calendar date with the correct month and day. Enter the month (mmm) from JANuary to DECember. Enter the date (dd) from 1 to 31. |

## SET TIMe

SET TIMe

Set Time of Day

**SET TIMe [?|<hh:mm>]**

This command sets or prints the time of day.

| | |
|---|---|
| **SET TIMe ?** | :Print the time of day. |
| **SET TIMe <hh:mm>** | :Set the time of day in hours and minutes using the 24 hour clock format. |

## SONet DS1 CHAnnel

SONet DS1 CHAnnel

Set SONET DS1 Channel

**SONet DS1 CHAnnel [?|{1|2 to 28}]**

This command sets or prints the DS1 channel (1 to 28) from the SONET DS1 signal. This command is only functional when a SONET drop option is installed.

| | |
|---|---|
| **SONet DS1 CHAnnel ?** | :Print the current SONET DS1 channel status. |
| **SONet DS1 CHAnnel 1 to 28** | :Set the SONET DS1 channel from 1 to 28. |

EXAMPLE:

| | |
|---|---|
| **> SON DS1 CHA ?** | :Print the current SONET DS1 channel status. |
| 10 | :Channel 10 is the currently selected DS1 channel. |
| **> SON DS1 CHA 5** | :Set the SONET DS1 channel to 5. |
| > | |

## SONet INPut

SONet INPut

Select SONET Interface Input

**SONet INPut [?|STS-1|OC-1|OC-3]**

This command sets or prints the SONET input. The command only applies when the 310-4A SONET Drop (STS-1, OC-1/3) Option is installed.

| | |
|---|---|
| **SONet INPut ?** | :Print the current SONET input status. |
| **SONet INPut STS-1** | :Set the SONET input to STS-1. The STS-1 signal is taken from the STS-1 RECEIVE jack. |
| **SONet INPut OC-1** | :Set the SONET input to OC-1. The OC-1 signal is taken from the OC-1/3 RECEIVE connector. |
| **SONet INPut OC-3** | :Set the SONET input to OC-3. The OC-3 signal is taken from the OC-1/3 RECEIVE connector. The **SONet STS ID** command is used to select an individual STS-1. |

See also: **SONet STS ID**

EXAMPLE:

| | |
|---|---|
| **> SON INP ?** | :Print the current SONET input status. |
| OC-3 | :The OC-1/3 RECEIVE connector is selected. |
| **> SON INP STS-1** | :Set the SONET input to STS-1. |
| **>** | |

**STS RX LEVel** **STS RX LEVel**

Set SONET STS Receive Input Level

**STS RX LEVel [?|DSX|HIGh]**

This command sets or prints the STS receive input level. This command is only functional when a SONET drop option is installed.

| | |
|---|---|
| **STS RX LEVel ?** | :Print the current STS receive input level status. |
| **STS RX LEVel DSX** | :Set the STS receive input level to DSX. |
| **STS RX LEVel HIGh** | :Set the STS receive input level to HIGH. |

See also: **SONet INPut**

EXAMPLE:

| | |
|---|---|
| **> STS RX LEV ?** | :Print the current STS receive input level status. |
| HIGh | :The STS receive input level is set to HIGH. |
| **> STS RX LEV DSX** | :Set the STS receive input level to DSX. |
| **>** | |

## TERminal

TERminal

Enter Terminal Mode

**TERminal ( . )**

:This command places the T-BERD 310 in the terminal control mode from either the local or remote mode. The command enables the **PROmpt** and **ECHo** commands and disables front-panel switches (except **RESULTS** switches). The command also sets the **PRInt TERminator** command to **CRLf** and the **PRInt WIDth** command to **80**. The message "232 REMOTE CONTROL" flashes in the MODE/PATTERN window. A period ( . ) can be used in place of **TER**.

See also: **PROmpt, ECHo, LOCal,** and **REMote**

EXAMPLE (local to terminal mode):

:Enter **TER** or ". ". The T-BERD 310 (and 310-1) enters local mode. The command is not echoed back from the T-BERD 310.

```
Terminal mode activated.
Enter "HELP" or "?" followed by <RETURN> for help.
>
```

:The T-BERD 310 responds with this message and is in terminal mode. The **PROmpt** and **ECHo** commands are enabled and front-panel switches (except **RESULTS** switches) are disabled. "232 REMOTE CONTROL" flashes in the MODE/PATTERN window.

**TESt** **TESt**

Set Test Duration

**TESt [?|CONtinuous|TIMed]**

This command sets or prints the duration of the test being performed.

| | |
|---|---|
| **TESt ?** | :Print the test duration. |
| **TESt CONtinuous** | :Set to continuous testing. The test results indicate accumulative counts since test restart. |
| **TESt TIMed** | :Set to timed testing. Set the test length with the **TESt LENgth** command. The test results indicate accumulative counts since test restart. |

See also: **TESt LENgth** and **PRInt EVEnt**

## TESt LENgth

TESt LENgth

Set Timed Test Length

**TESt LENgth [?|<hh:mm>]**

This command sets or prints the timed test length. This command is required when the **TESt** command is set to **TIMed**. If the **PRInt EVEnt** command is set to **TESt END**, a timed test *result* printout is generated at the end of the test.

| | |
|---|---|
| **TESt LENgth ?** | :Print the timed test length. |
| **TESt LENgth <hhh:mm>** | :Set the test length time in hours and minutes from 00:01 to 999:59. |

See also: **TESt** and **PRInt EVEnt**

## TRAnsmit OUTput

TRAnsmit OUTput

Set DS3 Transmit Output Level

**TRAnsmit OUTput [?|HIGh|DSX|LOW]**

This command sets or prints the DS3 transmit output level.

| | |
|---|---|
| **TRAnsmit OUTput ?** | :Print the transmit output level. |
| **TRAnsmit OUTput HIGh** | :Set the transmit output level to HIGH. |
| **TRAnsmit OUTput DSX** | :Set the transmit output level to DSX. |
| **TRAnsmit OUTput LOW** | :Set the transmit output level to LOW. |

## TRAnsmit TIMing

TRAnsmit TIMing

Set DS3 Transmit Timing Source

**TRAnsmit TIMing [?|INTernal|EXTernal|RECovered]**

This command sets or prints the DS3 transmit timing source. If the DS1 INSERT mode is selected, the DS3 transmit timing source defaults to recovered timing.

| | |
|---|---|
| **TRAnsmit TIMing ?** | :Print the DS3 transmit timing source. |
| **TRAnsmit TIMing INTernal** | :Set the DS3 transmit timing source to INTERNAL. |
| **TRAnsmit TIMing EXTernal** | :Set the DS3 transmit timing source to EXTERNAL. |
| **TRAnsmit TIMing RECovered** | :Set the DS3 transmit timing source to RECOVERED. |

## TX X-Bit

TX X-Bit

Set Transmitted X-Bit Pattern

**TX X-Bit [?|00|11|EMUlate]**

This command sets or prints the transmitted X-bit setting.

| | |
|---|---|
| **TX X-Bit ?** | :Print the transmitted X-bit setting. |
| **TX X-Bit [00\|11]** | :Set the transmitted X-bits to 00 or 11 ($X_0$ $X_1$). |
| **TX X-Bit EMUlate** | :Set the transmitted X-bit setting to EMULATE. EMULATE enables the T-BERD 310 to respond with the appropriate error message when an error is detected. |

## USER1 USER1

Set User-Programmable Test Pattern

**USER1 [?|{000|001 to 111111111111111111111111}]**

This command sets or prints the user-programmable 3- to 24-bit test pattern. The command only applies when the **USER1** test pattern is selected with the **PATtern** command. The pattern is transmitted from left to right.

| | |
|---|---|
| **USER1 ?** | :Print the user-programmable test pattern. |
| **USER1 [000\|001 to 111111111111111111111111]** | :Set the test pattern in a binary format from 000 to 111111111111111111111111. |

See also: **PATtern**

EXAMPLE:

| | |
|---|---|
| **> USER1** | :Print the current user-programmable test pattern. |
| 101010 | |
| **> USER1 110011000** | :Set the test pattern to 110011000. |
| **> PAT USER1** | :Set the test pattern to USER1. |
| **>** | |

## 5.7 310-1 REMOTE CONTROL OPERATION

This section describes the remote control commands used to control the 310-1 DS1/DS0 Analyzer Option from a remote device.

All 310-1 commands must be preceded with an "@" character to distinguish them from T-BERD 310 commands. The 310-1 commands are divided into three categories: front-panel switch commands, auxiliary function commands, and remote control-only commands. The front-panel switch commands are listed alphabetically in Table 5-6. The auxiliary function commands are listed alphabetically in Table 5-7. The remote control-only commands are listed alphabetically in Table 5-8. The 310-1 commands are described in alphabetical order in Section 5.7.2.

When remote control is activated (enter valid command), both the 310-1 and the T-BERD 310 are placed under remote control. The same applies to exiting remote control. While in remote control, the front-panel switches on both panels are disabled except for the **RESULTS** switches.

### 5.7.1 310-1 Error Messages

A command entered without the "@" character can be interpreted as a T-BERD 310 command or as invalid. If an invalid command is entered, the T-BERD 310/310-1 sends an error message indicating the error. Refer to Appendix B for additional error messages.

### 5.7.2 310-1 Remote Control Commands

The 310-1 remote control commands are listed in alphabetical order.

**Table 5-6**
**310-1 Front-Panel Switch Commands**

| Command | Switch Name | Description |
|---|---|---|
| @CODe | CODE | Set DS1 Code Type |
| @CONtrols | PRINT CONTROLS | Generate *Controls* Printout |
| @DISplay HOLd [ ] | DISPLAY HOLD | Set Display Hold |
| @DS0 DROp CHAnnel [ ] | DS0 DROP CHANNEL | Set Dropped DS0 Channel |
| @DS1 SOUrce [ ] | DS1 SOURCE | Set DS1 Input Source |
| @ERRor INSert BPV [ ] | BPV ERROR INSERT | Execute BPV Insertion |
| @ERRor INSert LOGic [ ] | LOGIC ERROR INSERT | Execute Logic Error Insertion |
| @HIStory RESet | HISTORY RESET | Clear History Alarm LEDs |
| @LOOp DOWn [ ] | LOOP DOWN | Generate Loop-Down Code |
| @LOOp UP [ ] | LOOP UP | Generate Loop-Up Code |
| @MODe [ ] | MODE | Set Transmit and Receive Operating Mode |
| @PATtern [ ] | PATTERN | Set Data Pattern |
| @PRInt CONtrols | PRINT CONTROLS | Generate *Controls* Printout |
| @PRInt RESults | PRINT RESULTS | Generate Test *Results* Printout |
| @RECeive INPut [ ] | RECEIVE INPUT | Set DS1 Receive Input Level |
| @RES1/2 [ ] | RESULTS I or II | Result Display I/II Control |
| @RESTART | RESTART | Initiate Test Restart |
| @RESUlts | PRINT RESULTS | Generate Test *Results* Printout |
| @TRAnsmit TIMing [ ] | TRANSMIT TIMING | Set DS1 Transmit Timing Source |

Table 5-7
310-1 Auxiliary Function Commands

| Command | AUX Name | Description |
|---|---|---|
| @DATaport [ ] | DATAPORT | Set DATAPORT Output |
| @ESF LOOp [ ] | ESF LOOP | ESF Loop Code Select |
| @LOOp CODe [ ] | LP CODE | Set DS1 Loop Code Type |
| @PGM LPDn [ ] | PGM LPDN | Set Programmable Loop-Down Code |
| @PGM LPUp [ ] | PGM LPUP | Set Programmable Loop-Up Code |
| @PRInt CUStom [ ] | CUSTOM | Set Custom *Results* Printout |
| @PRM EMUlate [ ] * | PRM | Set PRM Transmission Control |
| @PRM RECeive [ ] * | PRM | PRM Results Analysis Control |
| @SLIP REFerence [ ] * | SLIP REF | DS1 Timing Slip Reference Source |
| @USER1 [ ] | USER1 | Set User-Programmable Test Pattern |

* Requires the 310-9A Enhanced ESF/DS1 Timing Slips Option

Table 5-8
310-1 Remote Control-Only Commands

| Command | Description |
|---|---|
| @HELP | Display On-Line Help |
| @LEDs | Print State of Status and Alarm LEDs |
| @PRInt [ ] | Print Selected Test Result |

@CODe

Set DS1 Code Type

**@CODe [?|AMI|B8Zs]**

This command sets or prints the transmitted DS1 code type.

| | |
|---|---|
| **@CODe ?** | :Print the DS1 code status. |
| **@CODe AMI** | :Set the DS1 code to alternate mark inversion (AMI). |
| **@CODe B8Zs** | :Set the DS1 code to B8ZS encoding. |

NOTE: The command only controls the transmitted signal coding, not the receiver configuration. The command is not valid in the ESFz mode.

See also: **@MODe**

EXAMPLE:

| | |
|---|---|
| **> @COD** | :Print the DS1 code status. |
| AMI | :AMI is the currently selected line coding. |
| **> @COD B8Z** | :Set the transmitted code type to B8ZS encoding. |
| **>** | |

@CONtrols @CONtrols

Generate *Controls* Printout

**@CONtrols** :This command generates a *controls* printout of the 310-1 front panel configuration. The **@PRInt CONtrols** command performs the same function.

See also: **@PRInt CONtrols**

EXAMPLE:

**> @CON** :Print the 310-1 front-panel configuration.

```
>
- - - - - - - - - - - - - - - - - - - - - - -
            DS1 CONTROLS PRINT
- - - - - - - - - - - - - - - - - - - - - - -
AUG 12                              12:18:12
- - - - - - - - - - - - - - - - - - - - - - -
  DS1 PANEL SETTINGS
  - - - - - - - - - - - - - - - - - - - -
    Mode:                               T1
    Pattern:                          QRSS
    DS1 Source:                    DS3 DROP
    TX Timing:                     INTERNAL
    Code:                               AMI
    Logic Err Insert:                   OFF
    BPV Err Insert:                     OFF
                    .
                    .
                    .

  AUX FUNCTIONS
  - - - - - - - - - - - - - - - - - - - -
    User1:                         100000
    Pgm Loop Up:                    10000
    Pgm Loop Down:                    100
    Loop Code:                        CSU
    Data Port:                        DS0


              END OF PRINTOUT

>
```

**@DATaport** **@DATaport**

Set DATAPORT Output

**@DATaport [?|DATalink|DS0]**

This command sets or prints the side-panel DATAPORT output.

| | |
|---|---|
| **@DATaport ?** | :Print the DATAPORT output status. |
| **@DATaport DATalink** | :Set the DATAPORT output to access either the ESF, ESFz, or SLC-96 datalink. The **MODe** command must be set to either ESF, ESFz, or SLC-96 respectively. |
| **@DATaport DS0** | :Set the DATAPORT output to access a DS0 channel. The DS0 channel is selected with the **@DS0 DROp CHAnnel** command. |

See also: **@DS0 DROp CHAnnel** and **@MODe**

EXAMPLE:

| | |
|---|---|
| **> @DAT ?** | :Print DATAPORT output status. |
| DATALINK | :The DATAPORT output is the datalink channel. |
| **> @DAT DS0** | :Set the DATAPORT output for a DS0 channel. |
| **> @DS0 DRO CHA 5** | :Set the DS0 drop channel to channel five. |
| **>** | |

**@DISplay HOLd** **@DISplay HOLd**

Set Display Hold

**@DISplay HOLd [?|ON|OFF]**

This command sets or prints the display hold.

| | |
|---|---|
| **@DISplay HOLd ?** | :Print the display hold status. |
| **@DISplay HOLd ON** | :Activate the display hold function. The results and the Status and Alarm LEDs are frozen. |
| **@DISplay HOLd OFF** | :Disable the display hold function. The results and the Status and Alarm LEDs are released and updated. |

NOTE: While the **@DISplay HOLd** command is ON, updated results can be checked with the **@RES1/2** command.

See also: **@PRInt** and **@RESUlts**

EXAMPLE:

| | |
|---|---|
| **> @DIS HOL ?** | :Print the display hold setting. |
| OFF | :The display hold is disabled. |
| > | |

## @DS0 DROp CHAnnel

@DS0 DROp CHAnnel

Set Dropped DS0 Channel

**@DS0 DROp CHAnnel [?|1 to 24|NONe]**

This command sets or prints the dropped DS0 channel.

| | |
|---|---|
| **@DS0 DROp CHAnnel ?** | :Print the dropped DS0 channel. |
| **@DS0 DROp CHAnnel 1 to 24** | :Select the DS0 channel to be dropped. DS0 channels are entered with numbers from 1 to 24. |
| **@DS0 DROp CHAnnel NONe** | :Set the DS0 channel to be dropped to none. |

EXAMPLE:

| | |
|---|---|
| **> @DS0 DRO CHA ?** | :Print the dropped DS0 channel status. |
| 10 | :Channel 10 is the currently dropped DS0 channel. |
| **> @DS0 DRO CHA NON** | :Set the dropped DS0 channel to none. |
| **>** | |

@DS1 SOUrce

@DS1 SOUrce

Set DS1 Input Source

**@DS1 SOUrce [?|DS3 DROp|EXTernal INPut|SONet DROp]**

This command sets or prints the DS1 input source.

| | |
|---|---|
| **@DS1 SOUrce ?** | :Print the DS1 source input status. |
| **@DS1 SOUrce DS3 DROp** | :Set the DS1 source input source to the received DS3 signal. The DS1 signal is dropped from the DS3 signal received at the PRIMARY DS3 RECEIVE INPUT jack. |
| **@DS1 SOUrce EXTernal INPut** | :Set the DS1 source input to the external input. The DS1 signal is received from the side-panel DS1 RECEIVE jack. |
| **@DS1 SOUrce SONet DROp** | :Set the DS1 input source to the received SONET signal. The DS1 signal is dropped from the SONET signal received from the side-panel STS-1 RECEIVE or OC-1/3 RECEIVE (optional) jack. This command is only functional when a SONET drop option is installed. |

EXAMPLE:

| | |
|---|---|
| **> @DS1 SOU ?** | :Print DS1 source input status. |
| EXTERNAL | :The DS1 source input is set to EXT. INPUT. |
| **> @DS1 SOU DS3 DRO** | :Set the DS1 source input to DS3 DROP. |
| **>** | |

## @ESF LOOp

@ESF LOOp

Set ESF Loop Code Type

**@ESF LOOp [?|IN|OUT]**

This command sets or prints the ESF loop code type. This only applies when transmitting loop codes in the ESF and ESFz modes and the 310-9A Enhanced ESF/DS1 Timing Slips Option is installed.

| | |
|---|---|
| **@ESF LOOp ?** | :Print the ESF loop code type setting. |
| **@ESF LOOp IN** | :Select the ESF in-band loop codes. |
| **@ESF LOOp OUT** | :Select the ESF out-of-band loop codes. |

See also: **@LOOp CODe** and **@MODe**

EXAMPLE:

| | |
|---|---|
| **> @ESF LOO ?** | :Print the ESF loop code type status. |
| In-band loop codes | :The ESF loop code type is in-band loop codes. |
| **> @ESF LOO OUT** | :Set the ESF loop code type for out-of-band loop codes. |
| **> @LOO COD LINE** | :Set the out-of-band loop code to LINE. |
| **> @LOO UP** | :Send the LINE loop-up code. |

@ERRor INSert BPV

Execute BPV Insertion

**@ERRor INSert BPV [?|OFF|RATe|SINgle]**

This command sets or prints the BPV insertion setting.

| | |
|---|---|
| **@ERRor INSert BPV ?** | :Print the BPV insertion setting. |
| **@ERRor INSert BPV OFF** | :Disable the continuous BPV insertion. This command only applies when the **RATe** parameter is used. |
| **@ERRor INSert BPV RATe** | :Insert continuous BPVs at a $10^{-3}$ error rate. |
| **@ERRor INSert BPV SINgle** | :Insert a single BPV. |

See also: **@ERRor INSert LOGic**

EXAMPLE:

| | |
|---|---|
| **> @ERR INS BPV ?** | :Print BPV insertion status. |
| RATE | :BPVs are being inserted continuously. |
| **> @ERR INS BPV OFF** | :Set the BPV insertion to OFF. |
| **>** | |

## @ERRor INSert LOGic

Execute Logic Error Insertion

**@ERRor INSert LOGic [?|OFF|RATe|SINgle]**

This command sets or prints the logic error insertion setting.

| | |
|---|---|
| **@ERRor INSert LOGic ?** | :Print the logic error insertion setting. |
| **@ERRor INSert LOGic OFF** | :Disable the continuous logic error insertion. This command only applies when the **RATe** parameter is used. |
| **@ERRor INSert LOGic RATe** | :Insert continuous logic errors at a $10^{-3}$ error rate. |
| **@ERRor INSert LOGic SINgle** | :Insert a single logic error. |

See also: **@ERRor INSert BPV**

EXAMPLE:

```
> @ERR INS LOG ?          :Print logic error insertion status.
OFF                       :The logic error insertion is OFF.
> @ERR INS LOG SIN        :Insert one logic error.
>
```

**@HELP** **@HELP**

Display On-Line Help

**@HELP [?|!|{6|@FROnt}|{7|@AUXiliary}|<command-name>]**

This command prints the on-line help pages for the 310-1.

**@HELP (?)** :Use either **@HELP** or **@?** to print the introduction to the 310-1 help pages. The help page identifies the command syntax for entering commands and a list of the available help page commands. The "**@?**" can be used in place of **@HELP** in the following commands. Use either the page number (e.g., **? 4**) or the page name (e.g., **? FRO**) to select the required help page.

**@HELP !** :List all the available 310-1 remote control commands.

**@HELP 6|@FROnt** :List the 310-1 front-panel remote control commands.

**@HELP 7|@AUXiliary** :List the 310-1 auxiliary function remote control commands.

**@HELP <command-name>** :Describe the **<command-name>** and any parameters in detail.

See also: **HELP**

EXAMPLE:

**> @? RESTART** :Print the **RESTART** help page.
Restart the current test.
**>**

**@HIStory RESet** **@HIStory RESet**

Clear History Alarm LEDs

**@HIStory RESet** :Clear any illuminated 310-1 History Alarm LED.

See also: **@LEDs**

Print State of Status and Alarm LEDs

**@LEDs** :This command prints the state of the Status and Alarm LEDs.

See also: **@HIStory RESet**

EXAMPLE:

**> @LED**

```
    - - alarms - -          - - status - -
OFF OFF  signal    loss     ON   T1 pulses
OFF OFF  frame     loss     ON   frame    sync
OFF OFF  pattern   loss     OFF  pattern  sync
OFF OFF  excess    zeros    ON   b8zs
OFF OFF  yellow    alarm
OFF OFF  all ones
  └──── history
```

>

## @LOOp CODe

@LOOp CODe

Set DS1 Loop Code Type

**@LOOp CODe [?|CSU|FAC1|FAC2|PGM|LINe|NETwork|PAYload]**

This command sets or prints the transmitted DS1in-band (CSU, FAC1, FAC2, and PGM) and ESF out-of-band (LINe, NETwork, and PAYload) loop code. The ESF out-of-band loop codes only apply when transmitting loop codes in the ESF and ESFz modes and the 310-9A Enhanced ESF/DS1 Timing Slips Option is installed.

| | |
|---|---|
| **@LOOp CODe ?** | :Print the DS1 loop code. |
| **@LOOp CODe CSU** | :Set the loop code type to CSU. The loop-up code is 10000 and the loop-down code is 100. |
| **@LOOp CODe FAC1** | :Set the loop code type to Facility 1. |
| **@LOOp CODe FAC2** | :Set the loop code type to Facility 2. |
| **@LOOp CODe PGM** | :Set the loop code type to Programmable. Use the **@PGM LPDn** and **@PGM LPUp** commands to program the loop codes. |
| **@LOOp CODe LINe** | :Set the ESF out-of-band loop code type to LINE. |
| **@LOOp CODe NETwork** | :Set the ESF out-of-band loop code type to NETWORK. |
| **@LOOp CODe PAYload** | :Set the ESF out-of-band loop code type to PAYLOAD. |

See also: **@ESF LOOP**, **@LOOp DOWn**, **@LOOp UP**, **@PGM LPDn**, and **@PGM LPUp**

## @LOOp DOWn

@LOOp DOWn

Generate Loop-Down Code

**@LOOp DOWn [?|ON|OFF]**

This command sets or prints the generated loop-down code.

**@LOOp DOWn ?** :Print the generated loop-down code status.

**@LOOp DOWn ON** :Transmit the loop-down code.

**@LOOp DOWn OFF** :Disable the transmitted loop-down code.

See also: **@ESF LOOp**, **@LOOp CODe**, and **@LOOp UP**

## @LOOp UP

@LOOp UP

Generate Loop-Up Code

**@LOOp UP [?|ON|OFF]**

This command sets or prints the generated loop-up code.

**@LOOp UP ?** :Print the generated loop-up code status.

**@LOOp UP ON** :Transmit the loop-up code.

**@LOOp UP OFF** :Disable the transmitted loop-up code.

See also: **@ESF LOOp**, **@LOOp CODe**, and **@LOOp DOWn**

**@MODe** **@MODe**

Set Transmit and Receive Operating Mode

**@MODe [?|AUTo|T1D4|T1Esf|T1ESFZ|T1Slc|T1]**

This command sets or prints the 310-1 transmit and receive operating mode.

| | |
|---|---|
| **@MODe ?** | :Print the operating mode. |
| **@MODe AUTo** | :Select the automatic configure frame and pattern mode. |
| **@MODe T1D4** | :Select the T1 D4 mode. |
| **@MODe T1Esf** | :Select the T1 ESF mode. |
| **@MODe T1ESFZ** | :Select the T1 ESFz mode.This command is valid only when the 310-9 Enhd ESF Analysis Option is installed. |
| **@MODe T1Slc** | :Select the T1 SLC mode. |
| **@MODe T1** | :Select the T1 unframed mode. |

@PATtern

Set Data Pattern

**@PATtern [?|1:1|1:7|2^15-1|2^20-1|2^23-1|3/24|ALL ONEs|QRSs|USER1]**

This command sets or prints the transmitted test pattern.

| | |
|---|---|
| **@PATtern ?** | :Print the pattern. |
| **@PATtern 1:1** | :Select the 1:1 pattern. |
| **@PATtern 1:7** | :Select the 1:7 pattern. |
| **@PATtern 2^15-1** | :Select the 32,767-bit pseudorandom pattern. |
| **@PATtern 2^20-1** | :Select the 1,048,575-bit pseudorandom pattern. |
| **@PATtern 2^23-1** | :Select the 8,388,607-bit pseudorandom pattern. |
| **@PATtern 3/24** | :Select the 3 IN 24 pattern. |
| **@PATtern ALL ONEs** | :Select the All Ones pattern. |
| **@PATtern QRSs** | :Select the QRSS pattern. |
| **@PATtern USER1** | :Select the fixed 3- to 24-bit user-programmable test pattern. Use the **@USER1** command to set the test pattern. |

See also: **@USER1**

 @PGM LPDn

Set Programmable Loop-Down Code

**@PGM LPDn [?|{000|001 to 11111111}]**

This command sets or prints the DS1 3- to 8-bit programmable loop-down code. Set the **@LOOp CODe** command to **PGM** to select the loop code. Set the **@LOOp DOWn** command to **ON** to transmit the loop code. The pattern is transmitted from left to right.

| | |
|---|---|
| **@PGM LPDn ?** | :Print the loop-down code. |
| **@PGM LPDn [000\|001 to 11111111]** | :Set the loop-down code in a binary format from 000 to 11111111. |

See also: **@LOOp CODe** and **@LOOp UP**

EXAMPLE:

| | |
|---|---|
| **> @PGM LPD ?** | :Print the loop-down code pattern. |
| 10101010 | :This is the loop-down code pattern. |
| **> @PGM LPD 111000** | :Set a 6-bit pattern of 111000. |
| **>** | |

@PGM LPUp

Set Programmable Loop-Up Code

**@PGM LPUp [?|{000|001 to 11111111}]**

This command sets or prints the DS1 3- to 8-bit programmable loop-up code. Set the **@LOOp CODe** command to **PGM** to select the loop code. Set the **@LOOp UP** command to **ON** to transmit the loop code. The pattern is transmitted from left to right.

| | |
|---|---|
| **@PGM LPUp ?** | :Print the loop-up code. |
| **@PGM LPUp [000\|001 to 11111111]** | :Set the loop-up code in a binary format from 000 to 11111111. |

See also: **@LOOp CODe** and **@LOOp DOWn**

EXAMPLE:

| | |
|---|---|
| **> @PGM LPU ?** | :Print the loop-up code pattern. |
| 10101010 | :This is the loop-up code pattern. |
| **> @PGM LPU 11000** | :Set a 5-bit pattern of 11000. |
| **>** | |

Print Selected Test Result

**@PRInt <result name>** :This command prints the selected 310-1 test result value.

*LOGIC Category*

| | |
|---|---|
| % EFS | Percentage of Error-Free Seconds |
| ASYNC ERR SEC | Asynchronous Errored Seconds |
| BIT ERR RATE | Bit Error Rate |
| BIT ERRORS | Bit Errors |
| CSES | Consecutive Severely Errored Seconds |
| SEV ERR SEC | Severely Errored Seconds |
| SLIPS | Pattern Slips |
| SYNC ERR SEC | Synchronous Errored Seconds |
| SYNC L SEC | Out-of-Synchronization Seconds |

*LOGIC Category, 310-10 G.821 Results Option*

| | |
|---|---|
| %AVAIL SEC | % Available Seconds |
| %DEG MIN | % Degraded Minutes |
| %SEVERR SEC | % Severely Errored Seconds |
| AVAIL SEC | Available Seconds |
| DEG MIN | Degraded Minutes |
| UNAVAIL SEC | Unavailable Seconds |

*BPV Category*

| | |
|---|---|
| BPV ERR RT | Bipolar Violation Rate |
| BPV ERR SEC | Bipolar Violation Seconds |
| VIOLATIONS | Bipolar Violations |

*BPV Category, 310-9A Enhanced ESF/DS1 Timing Slips Option*

| | |
|---|---|
| FAR BPV SEC | Far-End BPV Seconds |

*FRAME Category*

| | |
|---|---|
| CRC ERR RT | Cyclic Redundancy Check Error Rate |
| CRC ERR SEC | Cyclic Redundancy Check Errored Seconds |
| CRC ERRORS | Cyclic Redundancy Check Errors |
| CRC SES | Cyclic Redundancy Check Severely Errored Seconds |
| FRM ERR RT | Frame Error Rate |
| FRM ERR SEC | Frame Errored Seconds |
| FRM ERRORS | Frame Errors |
| FRM L SEC | Frame Loss Seconds |
| FRM SES | Frame Severely Errored Seconds |

Print Selected Test Result (Continued)

*FRAME Category, 310-9A Enhanced ESF/DS1 Timing Slips Option*

| | |
|---|---|
| FAR CRC ERR | Far-End CRC Error Events |
| FAR FRM ES | Far-End Frame Error Seconds |
| FAR FRM SES | Far-End Severely Errored Framing Seconds |
| FAR SLIP SEC | Far-End Controlled Slip Seconds |
| FCRC 1 | Far-End CRC 1 Bin |
| FCRC 2-5 | Far-End CRC 2 to 5 Bin |
| FCRC 6-10 | Far-End CRC 6 to 10 Bin |
| FCRC 11-100 | Far-End CRC 11 to 100 Bin |
| FCRC 101-319 | Far-End CRC 101 to 319 Bin |
| FCRC>319 | Far-End CRC 320 to 333 Bin |
| PAYLOAD SOURCE | Far-End Payload Source/Loopback |

*SIGNAL Category*

| | |
|---|---|
| RX FREQ | Received Frequency in Hertz |
| RX LVL dBdsx | Received Signal Level in dBdsx |
| SIG BIT | Channel A/BC/D Signaling Status |
| SIG L SEC | Signal Loss Seconds |
| VF LVL dBm | Received Signal Level in dBm |

*SIGNAL Category, 310-9A Enhanced ESF/DS1 Timing Slips Option*

| | |
|---|---|
| TIMING SLIPS | DS1 Timing Slips |

*TIME Category*

| | |
|---|---|
| DATE | Current Date |
| ELAPSED TIME | Elapsed Time |
| TEST LENGTH | Timed Test Length |
| TIME | Current Time of Day |
| TIME LEFT | Timed Test Time Left |

*TIME Category, 310-9A Enhanced ESF/DS1 Timing Slips Option*

| | |
|---|---|
| FAR PRM SEC | Far-End Performance Report Seconds |

See also: **@PRInt RESults**, **@RESUlts**, and **@RES1/2**

EXAMPLE:

```
> @PRI BIT ERRORS          :Print the BIT ERRORS result count.
2399                       :The BIT ERRORS result count is 2399.
>
```

**@PRInt CONtrols** **@PRInt CONtrols**

Generate *Controls* Printout

**@PRInt CONtrols** :This command generates a *controls* printout of the 310-1 front panel configuration. The **@CONtrols** command performs the same function.

See also: **@CONtrols**

EXAMPLE:

**> @PRI CON** :Print the 310-1 front-panel configuration.

```
>
- - - - - - - - - - - - - - - - - - - - - - - -
            DS1 CONTROLS PRINT
- - - - - - - - - - - - - - - - - - - - - - - -
AUG 12                              12:18:12
- - - - - - - - - - - - - - - - - - - - - - - -
 DS1 PANEL SETTINGS - - - - - - - - - - - - - -

    Mode:                                 T1
    Pattern:                            QRSS
    DS1 Source:                    DS3 DROP
    TX Timing:                     INTERNAL
    Code:                                AMI
    Logic Err Insert:                    OFF
    BPV Err Insert:                      OFF
    Loop Up Code:                        OFF
    Loop Down Code:                      OFF
    DS0 Drop Channel:                     24
    RX Input:                           TERM

  AUX FUNCTIONS
   - - - - - - - - - - - - - - - - - - - - - -
    User1:                            100000
    Pgm Loop Up:                       10000
    Pgm Loop Down:                       100
    Loop Code:                           CSU
    Data Port:                           DS0

              END OF PRINTOUT
>
```

 @PRInt CUStom

Set Custom *Results* Printout

**@PRInt CUStom [?|{<result name> (ON|OFF)}|{ALL (ON|OFF)}]**

This command sets or prints the selected test results for a custom *results* printout. The custom *results* printout is selected with the T-BERD 310 **PRInt FORmat** command set to **CUStom.** The custom *results* printout is generated with either the **@PRInt RESults** or **@RESUlts** command. Refer to the **@PRInt** command for a list of **<result names>.**

**@PRInt CUStom ?** :Print the selected test results for the custom *results* printout.

**@PRInt CUStom <result name> ON** :Set the **<result name>** to ON. A **<result name>** that is set to ON is printed in the custom *results* printout.

**@PRInt CUStom <result name> OFF** :Set the **<result name>** to OFF. A **<result name>** that is set to OFF is not printed in the custom *results* printout.

**@PRInt CUStom ALL ON** :Set ALL the **<result names>** and Status and Alarm LEDs to ON. The custom *results* printout lists all the test results.

**@PRInt CUStom ALL OFF** :Set ALL the **<result names>** and Status and Alarm LEDs to OFF. The custom *results* printout header is generated without the results.

See also: **@PRInt RESults** and **@RESUlts**

**@PRInt RESults** **@PRInt RESults**

Generate Test *Results* Printout

**@PRInt RESults** :This command generates a 310-1 test *results* printout.

See also: **@RESUlts**

EXAMPLE:

**> @PRInt RESults** :Print the test results.

```
>
- - - - - - - - - - - - - - - - - - - - -
          NORMAL RESULTS PRINT
  - - - - - - - - - - - - - - - - - - -
Manual                              AUG 12
Continuous                        12:23:58
   - - - - - - - - - - - - - - - - - - -
            DS1 TEST RESULTS
    - - - - - - - - - - - - - - - - - -
  DS1 STATUS
   - - - - - - - - - - - - - - - - - -
     T1 Pulses:                     ON
     Frame Sync:                    OFF
     Pattern Sync:                  ON
     B8ZS:                          OFF

                      .
                      .
                      .
              END OF PRINTOUT


>
```

@PRM EMUlate

Set PRM Transmission Control

**@PRM EMUlate [?|CARrier|CUStomer|OFF]**

This command sets or prints the PRM transmission control function. The command only applies when operating in the ESF and ESFz modes and the 310-9A Enhanced ESF/DS1 Timing Slips Option is installed.

| | |
|---|---|
| **@PRM EMUlate ?** | :Print the PRM transmission control function. |
| **@PRM EMUlate CARrier** | :Set the PRM transmission control function to carrier emulation. |
| **@PRM EMUlate CUStomer** | :Set the PRM transmission control function to customer emulation. |
| **@PRM EMUlate OFF** | :Turn the PRM transmission control function OFF. |

See also: **@PRM RECeive** and **@MODe**

## @PRM RECeive

@PRM RECeive

PRM Results Analysis Control

**@PRM RECeive [?|ON|OFF]**

This command sets or prints the PRM results analysis control function. The command only applies when operating in the ESF and ESFz modes and the 310-9A Enhanced ESF/DS1 Timing Slips Option is installed.

**@PRM RECeive ?** :Print the PRM results analysis control function.

**@PRM RECeive ON** :Turn the PRM results analysis control function ON.

**@PRM RECeive OFF** :Turn the PRM results analysis control function OFF.

See also: **@PRM EMUlate, @PRInt,** and **@MODe**

## @RECeive INPut

@RECeive INPut

Set DS1 Receive Input Level

**@RECeive INPut [?|BRIdge|DSX-mon|TERminate]**

This command sets or prints the DS1 RECEIVE jack receive input level.

**@RECeive INPut ?** :Print the receive input level.

**@RECeive INPut BRIdge** :Set the receive input to BRIDGE.

**@RECeive INPut DSX-mon** :Set the receive input to DSX-MON.

**@RECeive INPut TERminate** :Set the receive input to TERM.

## @RES1/2

@RES1/2

Test Results Display I/II Control

**@RES1/2 [?|<result name>]**

These commands set or print the test results being displayed in the 310-1 RESULTS I and RESULTS II windows. Refer to the **@PRInt** command for a list of valid **<result names>.**

| | |
|---|---|
| **@RES1/2 ?** | :Print the test result displayed in either the RESULTS I or RESULTS II windows. |
| **@RES1/2 <result name>** | :Display the **<result name>** in either the RESULTS I or RESULTS II window. |

See also: **@PRInt, @PRInt RESults,** and **@RESUlts**

EXAMPLE:

| | |
|---|---|
| **> @RES1 ?** | :Print result displayed in the RESULTS I window. |
| FRM ERR RATE | :The FRM ERR RATE result is displayed in the RESULTS I window. |
| **> @RES1 BPV ERR RT** | :Display the BPV RATE result in the RESULTS I window. |
| **>** | |

## @RESTART

@RESTART

Initiate Test Restart

| | |
|---|---|
| **@RESTART** | :This command restarts the 310-1 test. |

**@RESUlts** **@RESUlts**

Generate Test *Results* Printout

**@RESUlts** :This command generates a 310-1 test results printout.

See also: **@PRInt RESults**

EXAMPLE:

**> @RESUlts** :Print the current test results.

**>**

```
          NORMAL RESULTS PRINT
-------------------------------------
Manual                        AUG 12
Continuous                  12:23:58
-------------------------------------
            DS1 TEST RESULTS

  ------------------------

  DS1 STATUS
  ----------------------
    T1 Pulses:              ON
    Frame Sync:             OFF
    Pattern Sync:           ON
    B8ZS:                   OFF

  DS1 ALARMS           HIST  CURR
  ----------------------------
    Signal Loss:       OFF   OFF
    Frame Loss:        OFF   OFF
    Pattern Loss:      OFF   OFF
    Excess Zeros:      OFF   OFF


                    .
                    .
                    .
            END OF PRINTOUT
```

**>**

**@SLIP REFerence** **@SLIP REFerence**

DS1 Timing Slip Reference Source

**@SLIP REFerence [?|PRI DS3 DROp|SEC DS3 DROp|SONet DROp|DS1 RECeive|DS1 INSert]**

This command sets or prints the DS1 timing slip reference source for the TIMING SLIP result of the 310-9A Enhanced ESF/DS1 Timing Slips Option.

**@SLIP REFerence ?** :Print the timing slip reference source status.

**@SLIP REFerence PRI DS3 DROp** :Selects the DS1 channel that is internally dropped from the PRIMARY DS3 RECEIVE INPUT jack. The DS1 channel is selected with the **DS1 DROp CHAnnel** command.

**@SLIP REFerence SEC DS3 DROp** :Selects the DS1 channel that is internally dropped from the SECONDARY DS3 RECEIVE jack on the 310-3 DS1 Insert Option. The DS1 channel is selected with the **DS1 INSert CHAnnel** command.

**@SLIP REFerence SONet DROp** :Selects the DS1 channel that is internally dropped from the STS-1 RECEIVE jack or the OC-1/3 RECEIVE jack on the 310-4/A SONET Drop Option. The DS1 channel is selected with the **SONET DS1 CHAnnel** command (not the **DS1 DROp CHAnnel** command).

**@SLIP REFerence DS1 RECeive** :Selects the DS1 signal from the DS1 RECEIVE jack on the 310-1 DS1/DS0 Analyzer Option. The DS1 signal is selected with the **@DS1 SOUrce** command set to **EXTernal INPut.**

**@SLIP REFerence DS1 INSert** :Selects the DS1 signal from DS1 INSERT INPUT jack on the 310-3 DS1 Insert Option.

The DS1 test signal source is selected with the **@DS1 SOUrce** command. Table 5-9 indicates the relationship between the test signal source and the reference signal source.

**@SLIP REFerence** **@SLIP REFerence**

DS1 Timing Slip Reference Source (Continued)

**Table 5-9**
**DS1 Timing Slip Test and Reference Signals**

| Reference Signal Source | Test Signal Source @DS1 SOUrce Command: DS3 DROp | SONET DROp | EXTernal INPut |
|---|---|---|---|
| PRIMARY DS3 RECEIVE INPUT Jack | — | X | X |
| SECONDARY DS3 RECEIVE Jack | X | X | X |
| STS-1 RECEIVE Jack | X | — | X |
| OC-1/3 RECEIVE Connector | X | — | X |
| DS1 RECEIVE Jack | X | X | — |
| DS1 INSERT INPUT Jack | X | X | X |

X Valid selection.
— Same connection. The TIMING SLIP result indicates SAME REF.

See also: **DS1 DROp CHAnnel, DS1 INSert CHAnnel, SONet DS1 CHAnnel, @DS1 SOUrce,** and **@PRInt**

EXAMPLE:

| | |
|---|---|
| **>@SLIP REF ?** | :Print the timing slip reference source status. |
| PRI DS3 DROp | :The reference source is the PRIMARY DS3 RECEIVE INPUT jack. |
| **>@SLIP REF DS1 REC** | :Selects the DS1 signal from the DS1 RECEIVE jack on the 310-1 DS1/DS0 Analyzer Option. |
| **>** | |

Set DS1 Transmit Timing Source

**@TRAnsmit TIMing [?|INTernal|RECovered]**

This command sets or prints the DS1 transmit timing source.

| | |
|---|---|
| **@TRAnsmit TIMing ?** | :Print the DS1 transmit timing source. |
| **@TRAnsmit TIMing INTernal** | :Set the DS1 transmit timing to INTERNAL. |
| **@TRAnsmit TIMing RECovered** | :Set the DS1 transmit timing to RECOVERED. |

**@USER1** **@USER1**

Set User-Programmable Test Pattern

**@USER1 [?|{000|001 to 111111111111111111111111}]**

This command sets or prints the user-programmable 3- to 24-bit test pattern. The command only applies when the **@USER1** test pattern is selected with the **@PATtern** command. The pattern is transmitted from left to right.

| | |
|---|---|
| **@USER1 ?** | :Print the user-programmable test pattern. |
| **@USER1 [000\|001 to 111111111111111111111111]** | :Set the test pattern in a binary format from 000 to 111111111111111111111111. |

See also: **@PATtern**

EXAMPLE:

| | |
|---|---|
| **> @USE** | :Print the current user-programmable test pattern.101010 |
| **> @USE 110011000** | :Set the test pattern to 110011000. |
| **> @PAT USE** | :Set the test pattern to USER1. |
| **>** | |

# SECTION 6
# DS1/DS0 ANALYZER

# 310-1 DS1/DS0 ANALYZER OPTION

## 6.1 INTRODUCTION

This section provides information on the 310-1 DS1/DS0 Analyzer Option. The 310-1 attaches to the T-BERD 310 Communications Analyzer to provide DS1 and DS0 test and analysis capabilities from DS3, DS1, and SONET (with a SONET drop option) access points.

Appendix C shows the functional block diagram of the T-BERD 310 mainframe and the 310-1 DS1/DS0 Analyzer Option.

### 6.1.1 Features and Capabilities

The 310-1 is designed to test and analyze T-Carrier transmission systems at the DS1 and DS0 levels from DS3 or DS1 access points. The 310-1 provides the following features and capabilities:

**Analyzes a DS1 channel** dropped from a DS3, DS1, or SONET access point for out-of-service testing and in-service monitoring.

**Generates DS1 test patterns** (QRSS, 3 IN 24, 1:1, 1:7, ALL ONES, $2^{23}$-1, $2^{20}$-1, $2^{15}$-1, and programmable) with the appropriate DS1 framing requirements.

**Operates in T1 unframed and framed modes** which includes: T1 D4, T1 ESF, T1 ESFz, and SLC-96.

**Auto configure mode** enables the 310-1 to scan the received signal and configure itself to the signal framing and pattern.

**Displayed results** provide simultaneously accumulated logic, BPV, CRC, and frame error counts; error rates, errored seconds, and percent of error-free seconds results; pattern slips, received frequency measurement, D4, ESF, ESFz, and SLC signaling status.

**Monitors for T1 pulses, pattern and frame synchronization,** and reports them as successful events on the front panel.

**Monitors for signal, pattern, and frame losses** and reports them as current and historical alarm events on the front panel.

**Monitors for Excess Zeros, Yellow Alarms, and All Ones** conditions and reports them on the front panel.

**Logic error and BPV insertion** can be done as a single error or continuously at a rate of $10^{-3}$ to stress circuits or verify signal continuity between the transmitted and received signals.

**Transmit timing control** is provided through a front-panel switch for internal or recovered clock source.

**T1 DSX-level output** allows the 310-1 to be connected to a DS1 access point and transmit DS1 formatted test patterns.

**T1 input** accepts the DS1 signal from DS1 DSX access points.

**Selects individual DS0 channels** allowing data bits and D4, ESF, ESFz, and SLC signaling bits (A, B, C, and D) to be monitored.

**A speaker and VF output jack (with fixed output)** provide audible VF outputs for the selected DS0 channel.

**Fixed and programmable loop codes** provide remote loopback capabilities from a single site.

**A dataport interface** provides access to DS0 channels and the ESF, ESFz, and SLC datalinks.

**Operates with AMI, B8ZS, and ZBTSI** (with 310-9A Enhanced ESF/DS1 Timing Slips Option) encoded data.

### 6.1.2 Options and Accessories

The following options and accessories are available for the 310-1.

- 310-9A Enhanced ESF/DS1 Timing Slips Option adds ESF out-of-band loop codes, ESF PRM transmit and receive functions, and the ESFz (ZBTSI encoding) operating mode. It also adds the DS1 Timing Slips result to the SIGNAL category.

- 310-10 G.821 Results Option adds the CCITT G.821 performance analysis results to the T-BERD 310 and 310-1 LOGIC categories. The G.821 results include available seconds, % available seconds, % severely errored seconds, degraded minutes, % degraded minutes, and unavailable seconds.

- 19" Rack Mount, 41855-01.
- 23" Rack Mount, 41855-02.

## 6.2 INSTRUMENT DESCRIPTION

The front-panel switches, indicators, displays, and side-panel connectors related to the operation of the 310-1 DS1/DS0 Analyzer Option are described in the following sections (see Figure 6-1).

The 310-1 replaces the standard T-BERD 310 cover. An extension cable connects the 310-1 to the T-BERD 310 for power and communications. This connection is made through the 310-1 DS1/DS0 Analyzer Option port. DS1, ESF and SLC datalink, DS0, and VF signal connections for the 310-1 are provided through the T-BERD 310 side panel. A help card is located under the T-BERD 310 storage pouch. The card provides a quick reference to the 310-1 modes, patterns, auxiliary functions, and results.

NOTE: Throughout this section, a number appears after each control name. These numbers match the callouts in Figure 6-1 and can be used to quickly locate switches and indicators.

### 6.2.1 Initial Test Setup

This section describes the controls and indicators used to initially configure the T-BERD 310/310-1 to test a circuit from a DS1 access point. The following controls and indicators are described in the order that you would normally use them (see Figure 6-1).

- Power
- Front-panel display (1)
- **DS1 SOURCE** switch (2)
- **MODE** switch (3)
- **PATTERN** switch (4)
- **TRANSMIT TIMING** switch (5)
- **CODE** switch (6)
- **AUX** switch (7)

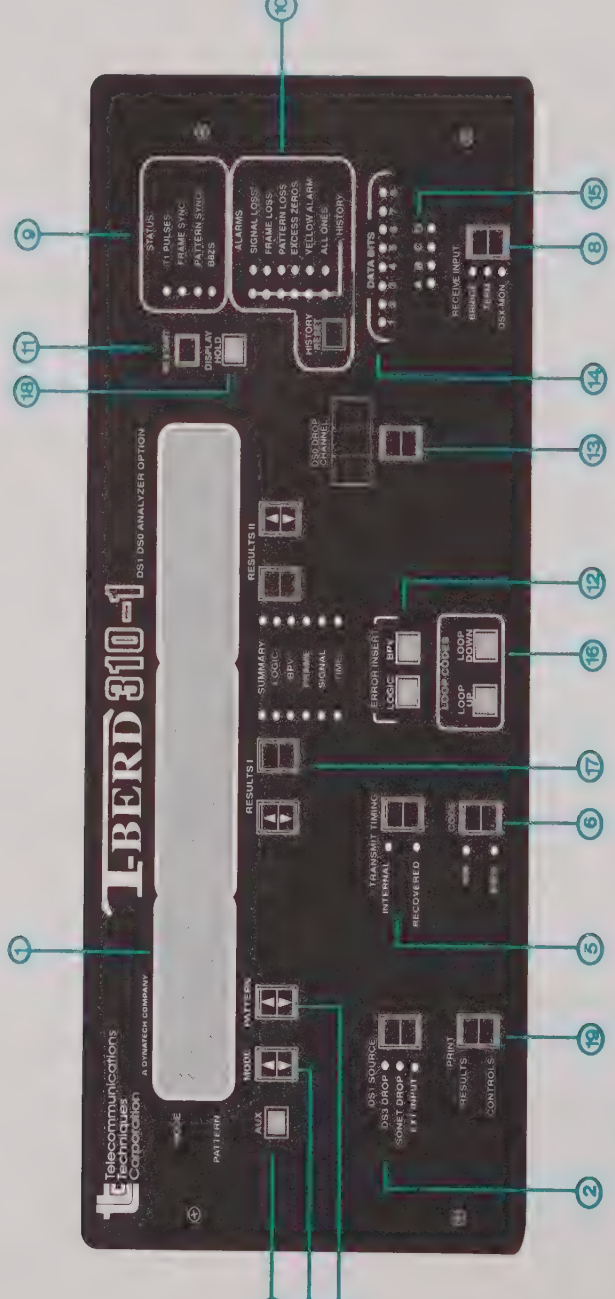



Figure 6-1
DS1/DS0 Analyzer Option Front Panel

**Power —** Power is supplied through the 310-1 DS1/DS0 Analyzer Option port connector and the T-BERD 310 AC power connection. During power-up, the 310-1 performs a self-test on itself and the interface with the T-BERD 310.

**Front-panel display** (1) — The display is divided into three windows: MODE/PATTERN, RESULTS I, and RESULTS II. The MODE/PATTERN window indicates the operating mode and test pattern of the 310-1. The RESULTS I and RESULTS II windows indicate the results of the 310-1.

**DS1 SOURCE switch** (2) — The **DS1 SOURCE** switch selects the DS1 input source for the 310-1. Press the **DS1 SOURCE** switch to select one of the following:

***DS3 DROP*** — The DS1 signal is provided internally from the T-BERD 310 and selected with the **DS1 DROP CHANNEL** switch.

***SONET DROP*** — If a SONET drop option is installed and a SONET DS1 payload is detected at the side-panel STS-1 RECEIVE or OC-1/3 RECEIVE jack, the DS1 signal is provided internally from the T-BERD 310. The SONET DS1 payload channel is selected through the SONET DS1 CH auxiliary function (see Section 8.3.3).

***EXT. INPUT*** — The DS1 signal is provided directly from the side-panel DS1 RECEIVE jack.

**MODE switch** (3) — The **MODE** switch selects the transmit and receive framing for the 310-1. Changing the mode causes a 310-1 test restart. Refer to Section 6.3 for additional information on the operating modes. Press the **MODE** switch to select:

| | |
|---|---|
| ***T1*** | T1 unframed mode |
| ***T1 D4*** | T1 D4 superframe mode |
| ***T1 ESF*** | T1 extended superframe mode |
| ***T1 ESFz*** | Optional T1 ZBTSI encoded extended superframe mode |
| ***T1 SLC*** | T1 subscriber loop carrier mode |
| ***AUTO*** | Automatic configure mode |

**PATTERN switch** (4) — The **PATTERN** switch selects the DS1 test pattern transmitted from the side-panel DS1 TRANSMIT jack. The selected test pattern is also used to obtain pattern synchronization on the receiver. Refer to Section 6.4 for more information on the test patterns. Changing the test pattern causes a 310-1 test restart. Press the **PATTERN** switch to select:

| | |
|---|---|
| ***QRSS*** | T1 quasi-random signal source pattern |
| ***2^23-1*** | 8,388,607-bit pseudorandom pattern |
| ***2^20-1*** | 1,048,575-bit pseudorandom pattern |
| ***2^15-1*** | 32,767-bit pseudorandom pattern |

| | |
|---|---|
| ***USER1*** | 3- to 24-bit programmable pattern |
| ***ALL ONES*** | All ones pattern |
| ***1:1*** | Alternating ones and zeros pattern |
| ***1:7*** | A one and seven zeros pattern |
| ***3 IN 24*** | Three ones in 24-bits pattern |

**TRANSMIT TIMING switch** (5) — The **TRANSMIT TIMING** switch selects the DS1 transmit clocking source for the transmitted DS1 signal. Changing this switch causes a 310-1 test restart. Press the **TRANSMIT TIMING** switch to select:

***INTERNAL*** — The transmit timing is generated by the internal crystal-controlled oscillator.

***RECOVERED*** — The transmit timing source is taken from the clock signal recovered from the received data. The LED flashes when no signal is present at the DS1 RECEIVE jack.

**CODE switch** (6) — The **CODE** switch selects the transmitted DS1 signal coding. The **CODE** switch only affects the transmitted output at the side-panel DS1 TRANSMIT jack. B8ZS decoding is performed automatically on the received input and is independent of the switch position. When B8ZS coding is detected, the B8ZS LED illuminates. When AMI coding is selected and B8ZS coding is detected, the message "B8ZS DETECTED" appears in the SUMMARY category and the B8ZS LED illuminates. When the optional T1 ESFz mode is selected, the **CODE** switch is disabled. Press the **CODE** switch to select:

***AMI*** — Alternate Mark Inversion line coding.

***B8ZS*** — Bipolar with 8-Zero Substitution encoding.

**AUX switch** (7) — The **AUX** switch provides access to a number of auxiliary functions which have limited use during normal testing. Pressing the **AUX** switch illuminates an internal switch LED which indicates the auxiliary functions are displayed and available for verification or modification. Refer to Section 6.5 for more information on the auxiliary functions. The auxiliary functions include:

| | |
|---|---|
| ***USER1*** | User 1 programmable test pattern |
| ***PGM LPUP*** | Programmable loop-up code |
| ***PGM LPDN*** | Programmable loop-down code |
| ***LP CODE*** | Loop code select |
| ***ESF LOOP*** | ESF Loop code select |
| ***PRM*** | ESF Datalink Performance Report Message control |
| ***DATAPORT*** | DATAPORT connector output |
| ***CUSTOM*** | Customized printout format |
| ***SLIP REF*** | DS1 timing slip reference source |

The entire front-panel display is used when the auxiliary functions are activated. The name of the auxiliary function is identified in the MODE/PATTERN window. The auxiliary function parameters appear in the RESULTS I and RESULTS II windows.

### 6.2.2 Test Connections

The 310-1 can receive and analyze a DS1 signal from DS1, DS3, and SONET DS1 signal sources. The 310-1 also provides connections to drop DS0, VF, and datalink (ESF, ESFz, and SLC-96) signals. Figure 6-2 shows the location of the 310-1 connections on the T-BERD 310 side panel. This section describes the following front- and side-panel connections and switch:

- DS1 RECEIVE jack
- **RECEIVE INPUT** switch (8) (see Figure 6-1)
- PRIMARY DS3 RECEIVE INPUT jack (see Figure 3-1)
- STS-1 RECEIVE or OC-1/3 RECEIVE connection (see Section 8)
- DS1 TRANSMIT jack
- DATAPORT connector
- VF OUT 600-OHM jack

#### Input Signal Connections

The following input signal connections are used to receive a DS1 signal from a DS1, DS3, or SONET source.

**DS1 RECEIVE jack** — The side-panel WECO 310 jack accepts DS1 level signals. The **DS1 SOURCE** switch must be set to EXT. INPUT to select the DS1 RECEIVE jack. The receive input level is controlled by the **RECEIVE INPUT** switch.

**RECEIVE INPUT switch (8) (see Figure 6-1)** — This switch selects the input level for the DS1 RECEIVE jack. Changing the switch position causes a test restart of the 310-1. The **RECEIVE INPUT** switch selections include:

***BRIDGE*** — Provides an input impedance greater than 1000 ohms for bridging lines that are already terminated. The BRIDGE setting provides Automatic Line Build-out (ALBO) compensation for cable losses of up to 35 dB. This is useful for bridging directly across copper cable pairs.

***TERM*** — Provides an input impedance of 100 ohms. The TERM setting provides ALBO compensation for cable losses of up to 35 dB. This is useful for terminating a circuit with the 310-1.

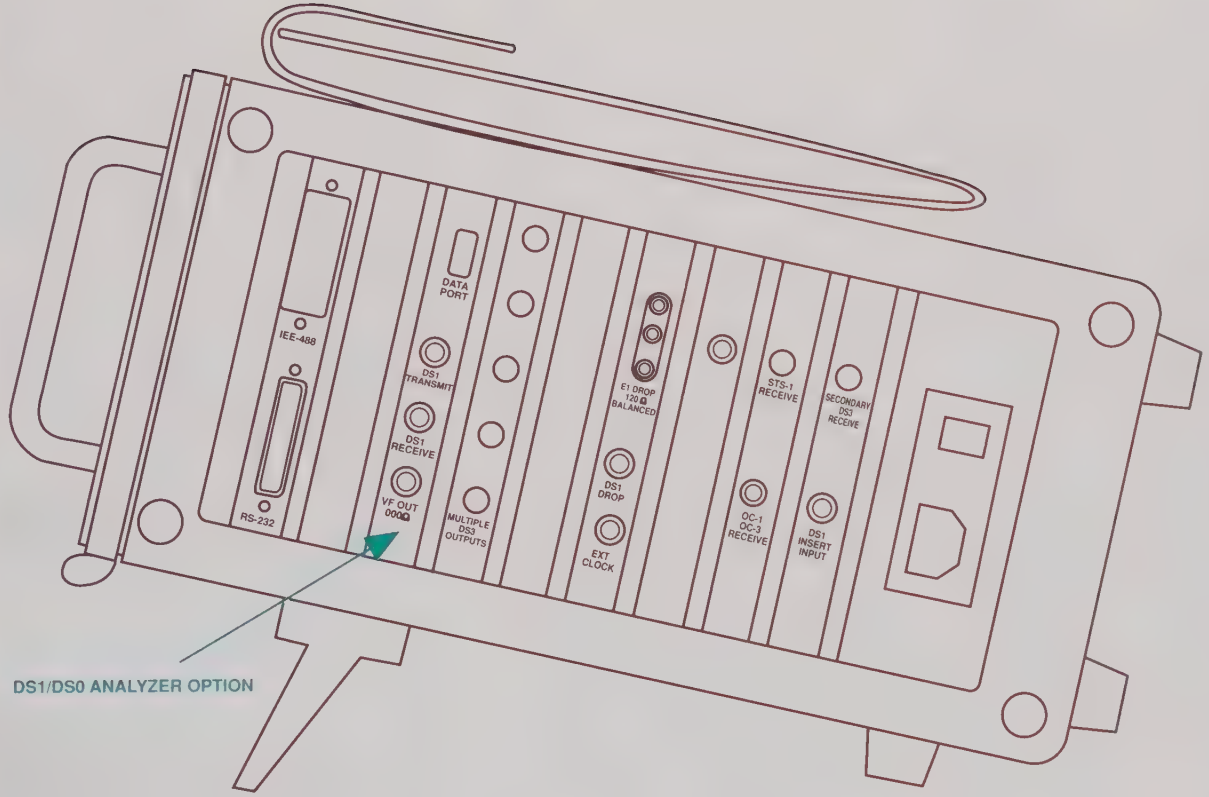



**Figure 6-2**
**DS1/DS0 Analyzer Option Connections**

***DSX-MON*** — Provides both 100 ohms of input impedance and compensation for resistive loss. DSX-MON is useful for monitoring T1 lines at DSX-monitor points which are resistor-isolated. When cable compensation is not desired, the line can be terminated with this selection.

**PRIMARY DS3 RECEIVE INPUT jack (see Figure 3-1)** — The DS1 channel can be dropped from the PRIMARY DS3 RECEIVE INPUT jack. To drop the DS1 signal from the PRIMARY DS3 RECEIVE INPUT jack, set the following switches:

***DS3 SOURCE switch (310)*** — Set to EXT.

***DS1 SOURCE switch (310-1)*** — Set to DS3 DROP.

***DS1 DROP CHANNEL switch (310)*** — Select the desired DS1 channel from the DS3 signal.

**STS-1 RECEIVE jack or OC-1/3 RECEIVE connector** — When a SONET drop option is installed (see Section 8), the DS1 channel can be dropped from a SONET DS3 payload received at the side-panel STS-1 (OC-1/3) RECEIVE jack. To drop a DS1 channel from a SONET DS3 payload, set the following switches:

***DS3 SOURCE switch (310)*** — Set to SONET.

***DS1 SOURCE switch (310-1)*** — Set to DS3 DROP.

***DS1 DROP CHANNEL switch (310)*** — Select the desired DS1 channel from the SONET DS3 payload.

A DS1 channel can also be dropped directly from a SONET signal containing VT1.5 payloads received at the STS-1 (OC-1/3) RECEIVE jack. To drop the DS1 channel from a VT1.5 mapped signal, set the following switch and auxiliary function:

***DS1 SOURCE switch (310-1)*** — Set to SONET DROP.

***SONET auxiliary group (310)*** — Select the SONET DS1 CH auxiliary function to drop the desired DS1 channel from the SONET DS1 payload.

### Output Signal Connections

The 310-1 provides connections that transmit framed and unframed T1 signals. DS0 channels or ESF, ESFz, and SLC-96 datalink signals can be dropped to external test sets. These connections are found on the T-BERD 310 side-panel and are described as follows:

**DS1 TRANSMIT jack** — This WECO 310 jack transmits DS1 signals with either AMI or B8ZS coding (see Section 6.2.1). The output signal format is controlled through the **MODE** switch.

**DATAPORT connector** — This 9-pin, female D connector provides access to the ESF, SLC-96, or ZBTSI datalinks and 64 or 56 kb/s DS0 channels. The DATAPORT is active only when frame synchronization is achieved. The DATAPORT auxiliary function controls the signal sent to the DATAPORT connector. Use the **MODE** switch to select the T1 ESF, T1 ESFz, or T1 SLC datalink. Use the **DS0 DROP CHANNEL** switch to select the DS0 channel. Refer to Section 11 for the DATAPORT connector pin assignments. A DATAPORT adaptor cable is available from TTC.

**VF OUT 600-OHM jack** — The WECO 310 jack provides a calibrated 0 dBm VF output across a 600-ohm termination. The output can also be heard from the speaker. The T-BERD 310 **VOLUME** switch only controls the speaker output. When frame synchronization is lost, the jack and speaker outputs are squelched.

### 6.2.3 Signal Verification

This section describes the following indicators and results used to verify that the 310-1 has properly acquired the received DS1 signal (see Figure 6-3).

- Status LEDs (9)
- Alarm LEDs (10)
- SUMMARY category

**Status LEDs** (9) — The following green Status LEDs provide information about the condition of the received DS1 signal. The Status LEDs are described as follows:

***T1 Pulses*** — Illuminates when the 310-1 detects multiple T1 pulses from one of three DS1 sources: the side-panel DS1 RECEIVE jack, channelized DS3, or SONET DS1 payload. If the received signal is lost, the LED goes out and the Signal Loss LED illuminates.

***Frame Sync*** — Illuminates when the 310-1 acquires frame synchronization. If the received framing format is lost, the LED goes out and the Frame Loss LED illuminates.

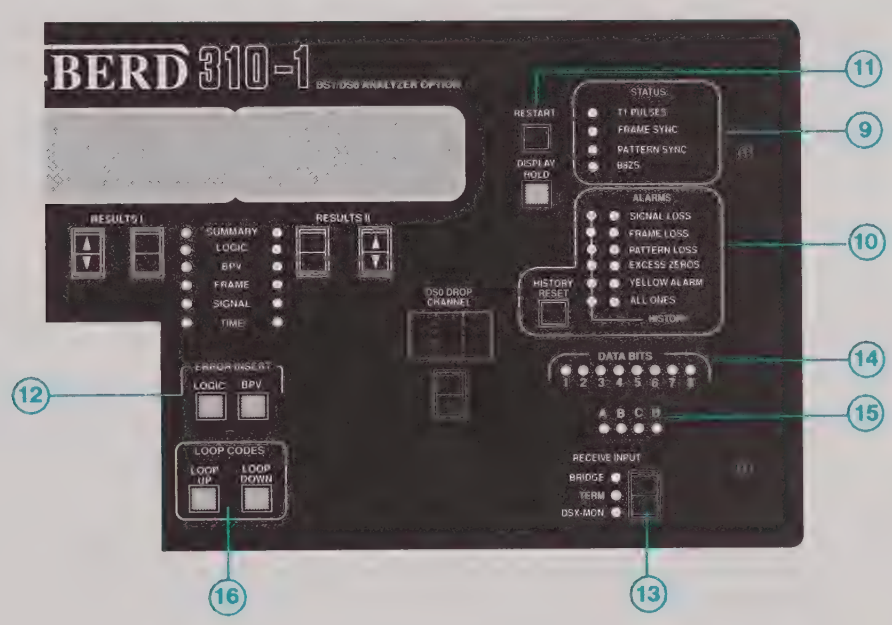



Figure 6-3
Controls and Indicators to Verify the Received Signal

***Pattern Sync*** — Illuminates when the 310-1 synchronizes to the test pattern displayed in the PATTERN window. If pattern synchronization is lost, the LED goes out and the Pattern Loss LED illuminates.

***B8ZS*** — Illuminates when B8ZS clear channel coding is detected in the received DS1 signal. When B8ZS encoding is detected and the **CODE** switch is set to AMI, the message "B8ZS DETECTED" is also displayed in the SUMMARY category. The LED is only active when the **DS1 SOURCE** switch is set to EXT. INPUT (side-panel DS1 RECEIVE jack).

**Alarm LEDs** (10) — The red Alarm LEDs provide information about the current and historical alarm conditions related to the received signal. These LEDs are divided into two columns (current and history) as shown in Figure 6-3. The right column illuminates when an alarm condition occurs and remains illuminated as long as the alarm exists. When the current alarm condition is cleared (e.g., pattern sync reestablished), the associated History LED illuminates. The History LEDs indicate past occurrences of the alarm and remain illuminated until either the **HISTORY RESET** switch is pressed or a 310-1 test restart occurs. The Alarm LEDs are described as follows:

***Signal Loss*** — Illuminates when no pulses are detected. When T1 pulses are detected again, the Alarm LED goes out, and the associated History LED and the T1 Pulses LED illuminate.

***Frame Loss*** — Illuminates when frame synchronization is lost. When DS1 framing is detected again, the Alarm LED goes out, and the associated History LED and the Frame Sync LED illuminate.

***Pattern Loss*** — Illuminates when pattern synchronization is lost. When the pattern is resynchronized, the Alarm LED goes out, and the associated History LED and Pattern Sync LED illuminate.

***Excess Zeros*** — Illuminates when excess zeros are detected in AMI or B8ZS coding. When excess zeros are no longer detected, the LED goes out and the associated History LED illuminates. The LED is only active when the **DS1 SOURCE** switch is set to EXT. INPUT.

***Yellow Alarm*** — Illuminates when a Yellow Alarm is detected. When the Yellow Alarm is no longer detected, the LED goes out and the associated History LED illuminates.

***All Ones*** — Illuminates when all ones are detected in framed and unframed DS1 signals. When All Ones are no longer detected, the LED goes out and the associated History LED illuminates.

***HISTORY RESET switch*** — This switch clears all History LEDs on the 310-1. This switch does not restart a test, nor does it affect any of the Alarm LEDs or accumulated results. The switch is not operable when the **DISPLAY HOLD** switch is activated. The **RESTART** switch also clears the History LEDs.

**SUMMARY category messages** — The SUMMARY category provides a convenient way to monitor specific results and measurements without having to search through the other categories. The SUMMARY category also provides a number of messages indicating whether the results are in or out of specification. The SUMMARY category is selected by pressing either the **RESULTS I Category** or the **RESULTS II Category** switch. When the category is selected, the appropriate yellow LED illuminates.

During initial acquisition of the received signal, the SUMMARY category should be displayed. The following messages can appear during signal acquisition:

***ALL RESULTS UNAVAILABLE*** — This indicates that the 310-1 has not detected the received signal.

***ALL RESULTS OK*** — This indicates that the 310-1 has detected and synchronized to the received signal and that no key results are non-zero or out-of-specification.

When an error is detected, the appropriate result appears in the SUMMARY category window. Refer to Section 6.6.1 for more information on the results that appear in the SUMMARY category.

### 6.2.4 Starting and Running the Test

This section explains the controls, indicators, and results used to run a test. The following front-panel controls and indicators are described in this section (see Figure 6-3):

- **RESTART** switch (11)
- **ERROR INSERT** switches (12)
- **DS0 DROP CHANNEL** switch (13)
- Data Bit LEDs (14)
- Channel signaling status LEDs (15)
- **LOOP CODE** switches (16)

**RESTART switch** (11) — Pressing the **RESTART** switch halts the current test, clears all results, clears the Status and Alarm LEDs, resynchronizes the receiver to the received signal, and restarts the test.

NOTE: Pressing one of the following switches also causes a test restart of the 310-1: **MODE, PATTERN,** and **RECEIVE INPUT**. Changing the USER1 auxiliary function when the USER1 test pattern is being transmitted also causes a test restart of the 310-1.

**ERROR INSERT switches** (12) — The two **ERROR INSERT** switches, **LOGIC** and **BPV**, insert logic errors and BPVs into the data stream individually or simultaneously. The **ERROR INSERT** switches perform the following functions:

***LOGIC ERROR INSERT switch*** — Press the **LOGIC ERROR INSERT** switch to insert single or continuous logic errors into the transmitted DS1 data and overhead bits. A single logic error is inserted when the **LOGIC** switch is pressed for less than one second. The switch LED flashes once indicating a single logic error is inserted. Continuous logic errors are inserted at a $10^{-3}$ error rate when the **LOGIC** switch is pressed for more than one second. The switch LED flashes once and then illuminates continuously. Pressing the illuminated switch again turns the error insertion off and extinguishes the LED. Logic error insertion affects the signal transmitted from the

side-panel DS1 TRANSMIT jack. It also affects the inserted DS1 signal when the DS1 INSERT mode is selected (see Section 7).

***BPV ERROR INSERT switch*** — Press the **BPV ERROR INSERT** switch to insert single or continuous BPVs into the transmitted DS1 signal. A single BPV is inserted when the **BPV** switch is pressed for less than one second. The switch LED flashes once indicating a single BPV is inserted. Continuous BPVs are inserted at a $10^{-3}$ error rate when the **BPV** switch is pressed for more than one second. The switch LED flashes once and then illuminates continuously. Pressing the illuminated switch again turns the error insertion off and extinguishes the LED. BPV insertion only affects the signal transmitted from the side-panel DS1 TRANSMIT jack.

**DS0 DROP CHANNEL switch and window** (13) — This switch selects the DS0 channel dropped from the DS1 signal. The selected DS0 signal appears at the Data Bit LEDs, Channel Signaling Status LEDs, T-BERD 310 speaker, side-panel VF OUT jack, and DATAPORT connector. The selected DS0 channel number (1 to 24) is visible in the channel window above the switch.

**Data Bit LEDs** (14) — The eight yellow LEDs indicate the contents of the selected DS0 channel. The Data Bit LEDs are not illuminated when frame synchronization is lost.

**Channel signaling status LEDs** (15) — The four LEDs, labeled A, B, C, and D, indicate the T1 ESF and T1 ESFz (ZBTSI) channel signaling status of the selected DS0 channel. LEDs A and B also indicate the T1 D4 and T1 SLC channel signaling status of the selected DS0 channel. The channel signaling status LEDs only respond to signaling after frame synchronization is established. All 24 DS0 channel signaling bits are displayed in the SIGNAL category "abcd" result (see Section 6.6.5).

**LOOP CODES switches** (16) — The **LOOP UP** and **LOOP DOWN** switches are used to generate loop codes to place CSUs or other facilities into loopback or release them from a loopback. When either switch is pressed, the displayed test pattern (in the PATTERN window) is replaced with a message indicating which loop code is being transmitted. When the loop code transmission is completed, the 310-1 returns to transmitting the selected test pattern, which is reflected in the window, and a test restart of the 310-1 occurs. The LP CODE auxiliary function selects the loop code type being transmitted (see Section 6.5.4). Four different loop codes can be selected (FACILITY 1, FACILITY 2, CSU, and PROGRAMMABLE).

***LOOP UP switch*** — This switch controls the transmission of the loop-up code selected through the LP CODE auxiliary function. When the **LOOP UP** switch is pressed, the LED inside the switch illuminates and the loop-up code is transmitted. The loop code is transmitted continuously until (1) the loop-up code is detected by the 310-1 receiver for 250 ms, (2) the **LOOP UP** switch is pressed again, (3) the **LOOP**

**DOWN** switch is pressed, or (4) a test restart of the 310-1 occurs. One of the following loop-up messages appear in the PATTERN window when a loop-up code is transmitted:

| | |
|---|---|
| **CSU LPUP** | The CSU loop-up code is being transmitted |
| **FAC1 LPUP** | The facility 1 loop-up code is being transmitted |
| **FAC2 LPUP** | The facility 2 loop-up code is being transmitted |
| **PGM LPUP** | The programmable loop-up code is being transmitted |

***LOOP DOWN switch*** — This switch controls the transmission of the loop-down code selected through the LP CODE auxiliary function. When the **LOOP DOWN** switch is pressed, the LED inside the switch illuminates and the loop-down code is transmitted. The loop code is transmitted continuously until either (1) the loop-down code is no longer detected by the 310-1 receiver, (2) the **LOOP DOWN** switch is pressed again, (3) the **LOOP UP** switch is pressed, or (4) a test restart of the 310-1 occurs. One of the following loop-down messages appear in the PATTERN window when a loop-down code is transmitted:

| | |
|---|---|
| **CSU LPDN** | The CSU loop-down code is being transmitted |
| **FAC1 LPDN** | The facility 1 loop-down code is being transmitted |
| **FAC2 LPDN** | The facility 2 loop-down code is being transmitted |
| **PGM LPDN** | The programmable loop-down code is being transmitted |

### 6.2.5 Collecting Test Results

This section describes the available test result categories and and the following controls to collect the test results.

- **RESULTS I** switches (17)
- **DISPLAY HOLD** switch (18)

**Categorized test results** — The results are divided into six categories. The first and most commonly used category is the SUMMARY category. During the initial test setup procedure, the SUMMARY category displays key non-zero or out-of-specification results. Refer to Section 6.6 for more information on test results. The available categories include:

***SUMMARY Category*** — Lists key results that are non-zero or out-of-specification.

***LOGIC Category*** — Lists pattern bit error related results.

***BPV Category*** — Lists bipolar violation related results.

***FRAME Category*** — Lists DS1 frame and CRC error related results.

***SIGNAL Category*** — Lists signal (frequency, level, and loss seconds) related results.

***TIME Category*** — Lists time related results.

**RESULTS switches and windows** — When the mode and pattern are displayed, two results are displayed simultaneously in the RESULTS I and RESULTS II windows. The available categories and results are selected with the following switches.

***RESULTS I and RESULTS II Category switches*** — Selects the category from the list of categories next to the switch. The labeled LEDs illuminate as the category is selected.

***RESULTS I and RESULTS II Results switches*** — Selects the individual results from the indicated category.

**DISPLAY HOLD switch** (18) — Pressing the **DISPLAY HOLD** switch temporarily freezes the results and Status and Alarm LEDs for the 310-1 only (see Figure 6-3). An internal switch LED illuminates to indicate that the results and LEDs are frozen. During the display hold, all results can be examined using the **RESULTS** switches. The results continue to accumulate in the background. When the **DISPLAY HOLD** switch is released, the results and LEDs are updated.

### 6.2.6 Printing the Test Setup and Results

The 310-1 provides manual *results* and *controls* printout capabilities through the **PRINT** switch. The T-BERD 310 **PRINT EVENT** switch and PRINT auxiliary group determine the 310-1 printout format and interval.

**PRINT switch (310-1)** (19) — The **PRINT** switch generates either a *results* or a *controls* printout. The switch positions are described as follows:

***RESULTS*** — Pressing the RESULTS position generates a date- and time-stamped printout of the current 310-1 results. Results become available only after the 310-1 has received a valid signal. The 310-1 results can be customized through the CUSTOM auxiliary function.

***CONTROLS*** — Pressing the CONTROLS position generates a date- and time-stamped printout of the current 310-1 front-panel and auxiliary function configuration. This printout records how the 310-1 is configured for testing.

**CUSTOM auxiliary function (310-1)** — The CUSTOM auxiliary function determines which DS1 results and Status and Alarm LED conditions are printed in a customized *results* printout. The custom *results* printout is selected through the T-BERD 310 FORMAT auxiliary function.

**PRINT EVENT switch (310) (see Figure 3-1)** — The T-BERD 310 **PRINT EVENT** switch selects the event that automatically initiates a *results* printout. Setting this switch to any print event selection generates both T-BERD 310 and 310-1 results. However, the printouts from each unit are generated independently from each other. Refer to Section 3.7.2 for more information on the **PRINT EVENT** switch.

**PRINT auxiliary group (310)** — The following auxiliary functions control the 310-1 *results* printouts in addition to the T-BERD 310 configuration (see Section 3.10.5).

| | |
|---|---|
| ***INTERVAL*** | Timed test length interval |
| ***MODE*** | Printout mode |
| ***FORMAT*** | Printout format |
| ***TERMINATOR*** | Printout line terminator |
| ***WIDTH*** | Printout line width |

## 6.3 OPERATING MODES

The **MODE** switch selects the transmit and receive framing format configuration for the 310-1 DS1/DS0 Analyzer Option. Press the **MODE** switch to select one of the following modes:

**T1** — Configures the 310-1 to transmit and receive unframed T1 signals.

**T1 D4** — Configures the 310-1 to transmit and receive D4 framed T1 signals.

**T1 ESF** — Configures the 310-1 to transmit and receive extended superframe (ESF) T1 signals. With the 310-9A option installed, the ESF out-of-band loop codes are available, and the ESF PRM can be transmitted and received.

**T1 ESFz** — Configures the 310-1 to transmit and receive Zero Byte Time Slot Interchange (ZBTSI) encoded ESF T1 signals. With the 310-9A option installed, the ESF out-of-band loop codes are available, the ESF PRM can be transmitted and received, and this mode is provided.

**T1 SLC** — Configures the 310-1 to transmit and receive Subscriber Loop Carrier (SLC) framed T1 signals.

**AUTO** — Configures the receiver to automatically scan and synchronize to the input signal framing and pattern information. After achieving synchronization, the transmitter regenerates the framing and test pattern without errors. When the framing format is recognized, the framing format name appears in lowercase characters in the MODE/PATTERN window. If "live" data is declared, the **TRANSMIT TIMING** switch defaults to RECOVD.

If the received signal is recognized as a test pattern:

- The test pattern name appears in lowercase characters in the PATTERN window.
- The transmitter is configured to generate the recognized framing format and test pattern.
- Logic and BPV errors can be inserted with the **ERROR INSERT** switches.
- Full DS1 logic, BPV, parity, frame, and signal error analysis is performed on the received signal.
- The appropriate LEDs illuminate.

If the received signal is *not* recognized as a test pattern, but live data:

- The word "live" appears in the PATTERN window.
- The transmitter retransmits the received signal, including errors.
- Logic errors and BPVs can be inserted with the **ERROR INSERT** switches.
- Full DS1 BPV, CRC, frame, and signal error analysis is performed on the received signal. The LOGIC category is not applicable during live data analysis.
- The appropriate LEDs illuminate.

## 6.4 TEST PATTERNS

The **PATTERN** switch selects the 310-1 test patterns. The DS1 test pattern is transmitted from the side-panel DS1 TRANSMIT jack. Press the **PATTERN** switch to select one of the following test patterns:

**QRSS** — A modified $2^{20}$-1 pseudorandom pattern which allows a maximum of 14 sequential zeros and 20 sequential ones. The QRSS pattern simulates live data for T1 applications.

**2^23-1** — An 8,388,607-bit pseudorandom pattern which generates a maximum of 22 sequential zeros and 23 sequential ones. This pattern conforms to CCITT Recommendation O.151. The pattern exceeds excess zeros and does not meet the minimum ones density requirements for T1 applications.

**2^20-1** — A 1,048,575-bit pseudorandom pattern which generates a maximum of 19 sequential zeros and 20 sequential ones. This pattern conforms to CCITT Recommendation O.151. The pattern exceeds excess zeros and does not meet the minimum ones density requirements for T1 applications.

**2^15-1** — A 32,767-bit pseudorandom pattern which generates a maximum of 14 sequential zeros and 15 sequential ones. This pattern conforms to CCITT Recommendation O.151. The pattern provides a maximum number of zeros allowed for framed, non-B8ZS testing. The pattern does not meet the minimum ones density requirement.

**USER1** — A 3- to 24-bit user-programmable test pattern. This allows the 310-1 to transmit specific bit patterns to test circuit sensitivity to a particular pattern. The pattern is entered in binary form through the USER1 auxiliary function.

**ALL ONES** — A fixed test pattern of only pulses (mark). This pattern is generally used to stress span repeater current regulator circuits. It can be used as an Alarm Indication Signal (AIS) in unframed circuits, or a keep alive signal, idle code, or red alarm in other circuits. The pattern is required to measure the signal power level in dBm (see SIGNAL category).

**1:1** — A fixed test pattern of alternating marks (1) and spaces (0). 1:1 is generally used to perform a minimum level stress test on clock recovery circuits.

**1:7** — A fixed test pattern of F01000000.... The pattern is aligned with the F-bits as indicated to prevent false Yellow Alarms. 1:7 is generally used to stress the 12.5% ones density requirement for T1 circuits.

**3 IN 24** — A fixed test pattern of F0100 0100 0000 0000 0000 0100.... The pattern is aligned with the F-bits as indicated. 3 IN 24 provides the minimum ones density (12.5%) and the maximum excess zeros (15) requirements to stress T1 circuits. When the pattern is framed, it violates the minimum ones density requirements.

## 6.5 AUXILIARY FUNCTIONS

Auxiliary functions allow access to parameters that are not frequently used and do not have dedicated switches. Press the **AUX** switch to access the auxiliary functions. The auxiliary functions appear in all three display windows. Table 6-1 lists the auxiliary functions. The **PATTERN**, **RESULTS I** and **RESULTS II** switches are used to manipulate the displayed auxiliary function. The switches perform the following functions:

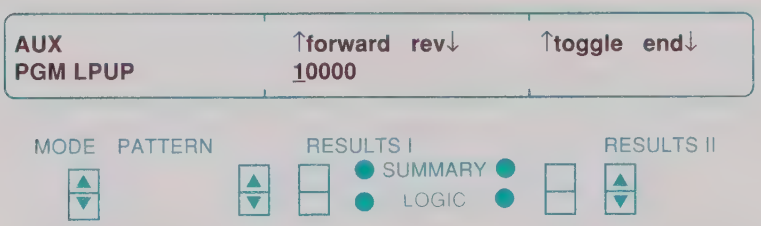
**PATTERN switch** — Press this switch to scroll through the auxiliary functions.

**RESULTS I and RESULTS II switches** — These switches are used in combination to change or enter information into the selected auxiliary function.

Table 6-1
310-1 DS1/DS0 Analyzer Auxiliary Functions

| Displayed Name | Description |
|---|---|
| USER1 | User 1 Programmable Test Pattern |
| PGM LPUP | Programmable Loop-Up Code |
| PGM LPDN | Programmable Loop-Down Code |
| LP CODE | Loop Code Select |
| ESF LOOP | ESF Loop Code Select |
| PRM | ESF Datalink Performance Report Message Control |
| DATAPORT | DATAPORT Connector Output |
| CUSTOM | Customized Printout Format |
| SLIP REF | DS1 Timing Slip Reference Source |

### 6.5.1 USER1 — User-Programmable Test Pattern

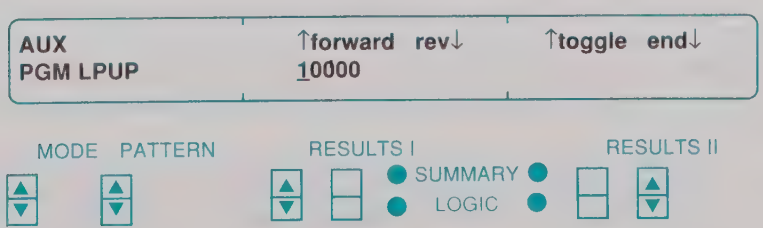



The USER1 auxiliary function programs a 3- to 24-bit user-programmable test pattern. This allows the 310-1 to transmit specific patterns to test circuit sensitivity. The pattern is transmitted when the USER1 pattern is selected with the **PATTERN** switch. The pattern is transmitted in left-to-right order. A test restart of the 310-1 occurs when the pattern is saved while the USER1 pattern is transmitted. The test pattern is programmed with the following switches:

**RESULTS I Results switch —** Press the up arrow to move the cursor forward from left to right. Moving the cursor forward past the last displayed bit automatically inserts a "0" in each new position up to 24 bits. Press the down arrow to move the cursor in reverse from right to left.

**RESULTS II Results switch —** Press the up arrow to toggle the highlighted bit between "1" and "0". Press the down arrow to end or save the bit pattern from the position of the cursor to the first bit on the left. Any bits to the right of the cursor are deleted when the down arrow is pressed. The pattern is saved when *end* is selected.

### 6.5.2 PGM LPUP — Programmable Loop-Up Code




The PGM LPUP auxiliary function programs a 3- to 8-bit user-defined loop-up code. This allows the 310-1 to transmit nonstandard loop codes. The programmed loop-up code is

transmitted when the **LOOP UP** switch is pressed and the LP CODE auxiliary function is set to PROGRAMMABLE. The loop code is transmitted in left-to-right order. The loop-up code is programmed with the following switches:

**RESULTS I Results switch** — Press the up arrow to move the cursor forward from left to right. Moving the cursor forward past the last displayed bit automatically inserts a "0" in each new position up to eight bits. Press the down arrow to move the cursor in reverse from right to left.

**RESULTS II Results switch** — Press the up arrow to toggle the highlighted bit from 0 to 1. Press the down arrow to save and end the displayed bit pattern up to the position of the cursor. Any bits to the right of the cursor are deleted and the cursor returns to the left most bit position. The loop code is only saved when *end* is selected.

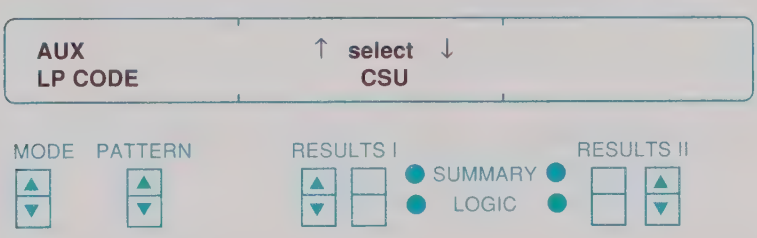
### 6.5.3 PGM LPDN — Programmable Loop-Down Code

The PGM LPDN auxiliary function programs a 3- to 8-bit user-defined loop-down code. This allows the 310-1 to transmit nonstandard loop codes. The programmed loop-down code is transmitted when the **LOOP DOWN** switch is pressed and LP CODE auxiliary function must be set to PROGRAMMABLE. The loop code is transmitted in left-to-right order. The loop-down code is programmed with the following switches:

**RESULTS I Results switch** — Press the up arrow to move the cursor forward from left to right. Moving the cursor forward past the last displayed bit automatically inserts a "0" in each new position up to eight bits. Press the down arrow to move the cursor in reverse from right to left.

**RESULTS II Results switch** — Press the up arrow to toggle the highlighted bit from 0 to 1. Press the down arrow to save and end the displayed bit pattern up to the position of the cursor. Any bits to the right of the cursor are deleted and the cursor returns to the left most bit position. The loop code is only saved when *end* is selected.

### 6.5.4 LP CODE — Loop Code Select




The LP CODE auxiliary function selects the in-band (in-band or ESF out-of-band) T1 loop code transmitted when the **LOOP CODE** switches are pressed. Transmitting a loop code restarts the test. The loop code bit patterns in the following descriptions are transmitted in left-to-right order. Press the **RESULTS I Results** switch to select one of the following in-band loop codes:

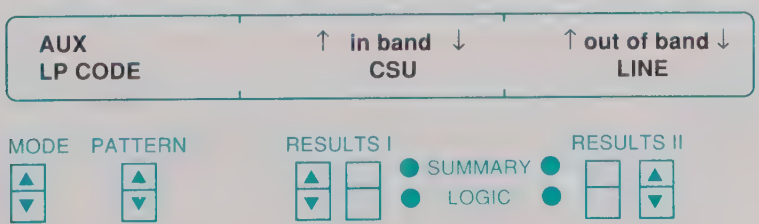
**CSU** — The Customer Service Unit loop codes allow the 310-1 to establish a loopback with a compatible CSU. The transmitted loop-up code is 10000 and the loop-down code is 100.

**PROGRAMMABLE** — The 3- to 8-bit programmable loop codes allow the 310-1 to establish a loopback with any nonstandard device. The loop codes are programmed through the PGM LPUP and PGM LPDN auxiliary functions.

**FACILITY 2** — The 5-bit facility or network (smart jack) loop codes allow the 310-1 to establish a loopback with a compatible facility interface. The transmitted loop-up code is 11000 and the loop-down code is 11100.

**FACILITY 1** — The 4-bit facility or network (smart jack) loop codes allow the 310-1 to establish a loopback with a compatible facility interface. The transmitted loop-up code is 1100 and the loop-down code is 1110.

When the 310-9A Enhanced ESF/DS1 Timing Slips Option is installed, the ESF out-of-band loop code selection appears in the RESULTS II window.



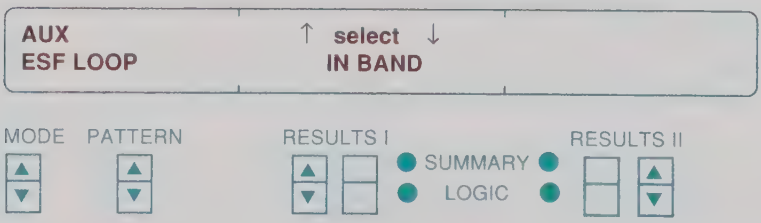
When the T1 ESF or T1 ESFz mode is selected, the ESF loop code type (in-band or out-of-band) is selected from the ESF LOOP auxiliary function (see Section 6.5.5). Press the **RESULTS I Results** switch to select one of the in-band loop codes. Press the **RESULTS II Results** switch to select one of the following ESF out-of-band loop codes:

**LINE** — The line loop codes allow the 310-1 to establish a loopback with a compatible terminal. The transmitted loop-up code is 1111 1111 0111 0000 and the loop-down code is 1111 1111 0001 1100.

**PAYLOAD** — The payload loop codes allow the 310-1 to establish a loopback with a compatible terminal. The transmitted loop-up code is 1111 1111 0010 1000 and the loop-down code is 1111 1111 0100 1100.

**NETWORK** — The network loop codes allow the 310-1 to establish a loopback with a compatible terminal. The transmitted loop-up code is 1111 1111 0100 1000 and the loop-down code is 1111 1111 0010 0100.

### 6.5.5 ESF LOOP — ESF Loop Code Select




The ESF LOOP auxiliary function selects the loop code type that is transmitted through an ESF circuit when the **LOOP CODE** switches are pressed. The specific loop code is selected through the LP CODE auxiliary function (see Section 6.5.4). Press the **RESULTS I Results** switch to select the method of transmitting the loop code:

**IN BAND** — The in-band loop codes (CSU, PGM, FAC1, and FAC2) are transmitted in place of the data or test pattern.

**OUT OF BAND** — The out-of-band loop codes (LINE, PAYLOAD, and NETWORK) are transmitted over the ESF datalink.

NOTE: This auxiliary function only appears when the 310-9A Enhanced ESF/DS1 Timing Slips Option is installed.

### 6.5.6 PRM — ESF Datalink Performance Report Message Control

The PRM auxiliary function determines how the PRM is transmitted and whether the PRM results are accumulated. The auxiliary function is only active in the ESF and ESFz operating modes (see Section 6.3). Press the **RESULTS I Results** switch to select how the PRM is transmitted from the 310-1.

**OFF** — The PRM transmit function is disabled.

**EMUL CUSTOMER** — Emulates the customer PRM. Selecting EMUL CUSTOMER sets the PRM C/R bit to 0.

**EMUL CARRIER** — Emulates the carrier PRM. Selecting EMUL CARRIER sets the PRM C/R bit to 1.

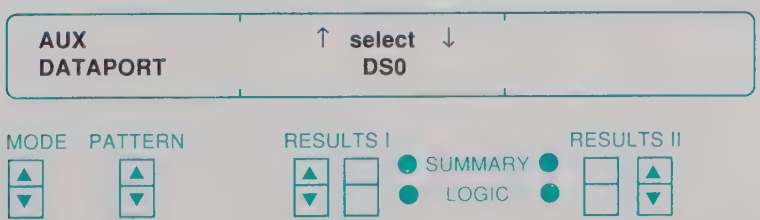
When transmitting the PRM, the SE bit is set to 1 when the 310-1 detects a frame loss in the received signal; SL bit is always set to 0; and the LB bit is always set to 0.

Press the **RESULTS II Results** switch to control the PRM receiver as follows:

**OFF** — The PRM receiver is disabled and the 310-1 does not report on the PRM status.

**ON** — The PRM receiver is enabled and the 310-1 reports on the PRM status in the BPV, FRAME, and TIME categories (see Section 6.6).

### 6.5.7 DATAPORT — DATAPORT Connector Output

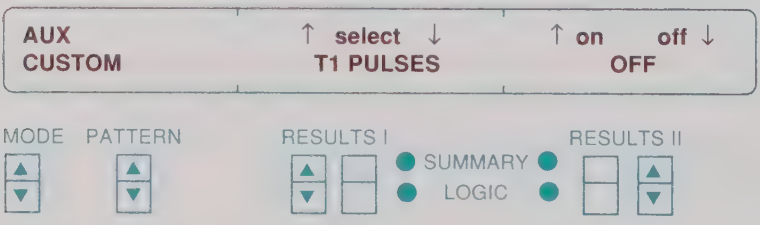


The DATAPORT auxiliary function selects the drop output (DS0 or datalink) for the side-panel DATAPORT connector (see Section 6.2.2). The DATAPORT is active only when frame synchronization is achieved. Press the **RESULTS I Results** switch to select one of the following outputs:

**DS0** — Provides access to the 56 or 64 kb/s DS0 channel selected with the **DS0 DROP CHANNEL** switch. The DS0 data bits can be monitored through the Data Bit LEDs or analyzed with an external test set.

**DATALINK** — Provides access to the ESF, optional ESFz, or SLC-96 formatted datalink output when the respective operating mode is selected. External decoding is required to separate the datalink bits from the Fs bits.

### 6.5.8 CUSTOM — Customized Printout Contents




The CUSTOM auxiliary function selects specific DS1 results and Status and Alarm LED conditions to be included in a *results* printout. Select the custom *results* printout from the T-BERD 310 FORMAT auxiliary function. Press the **RESULTS** switches to select the desired printout line items:

**RESULTS I Category switch** — Press this switch to select the desired category. The Status and Alarm LEDs and FEAC codes are selected from the SUMMARY category.

**RESULTS I Results switch** — Press this switch to select the results and LEDs. Refer to Section 6.6 for the available results.

**RESULTS II Results switch** — Press the up arrow to toggle ON or the down arrow to toggle OFF the status condition.

### 6.5.9 SLIP REF — DS1 Timing Slip Reference Source

The SLIP REF auxiliary function selects the TIMING SLIPS result reference signal source. This auxiliary function only appears when the 310-9A Enhanced ESF/DS1 Timing Slips Option is installed. Press the **RESULTS I Results** switch to select one of the following reference signal sources:

**PRI DS3 DROP** — Selects the DS1 channel that is internally dropped from the PRIMARY DS3 RECEIVE INPUT jack. The DS1 channel is selected with the **DS1 DROP CHANNEL** switch.

**SEC DS3 DROP** — Selects the DS1 channel that is internally dropped from the SECONDARY DS3 RECEIVE jack on the 310-3 DS1 Insert Option. The DS1 channel is selected with the **DS1 INSERT CHANNEL** switch.

**SONET DROP** — Selects the DS1 channel that is internally dropped from the STS-1 RECEIVE jack or the OC-1/3 RECEIVE jack on the 310-4/A SONET Drop Option. The DS1 channel is selected with the SONET DS1 CH auxiliary function (not the **DS1 DROP CHANNEL** switch).

**DS1 RECEIVE** — Selects the DS1 signal from the DS1 RECEIVE jack on the 310-1 DS1/DS0 Analyzer Option. The DS1 signal is selected with the **DS1 SOURCE** switch set to EXT. INPUT.

**DS1 INSERT** — Selects the DS1 signal from DS1 INSERT INPUT jack on the 310-3 DS1 Insert Option.

The DS1 test signal source is selected with the **DS1 SOURCE** switch. Table 6-2 indicates the relationship between the test signal source and the reference signal source.

Table 6-2
DS1 Timing Slip Test and Reference Signals

| Reference Signal Source | Test Signal Source DS1 SOURCE Switch | | |
|---|---|---|---|
| | DS3 DROP | SONET DROP | EXT. INPUT |
| PRIMARY DS3 RECEIVE INPUT Jack | — | X | X |
| SECONDARY DS3 RECEIVE Jack | X | X | X |
| STS-1 RECEIVE Jack | X | — | X |
| OC-1/3 RECEIVE Connector | X | — | X |
| DS1 RECEIVE Jack | X | X | — |
| DS1 INSERT INPUT Jack | X | X | X |

X Valid selection.
— Same connection. The TIMING SLIP result indicates SAME REF.

## 6.6 TEST RESULTS

The 310-1 has full Bit Error Rate Test (BERT) capabilities and supports all the DS1 results defined in the following sections. Two results can be displayed at one time in the RESULTS I and RESULTS II windows. The **RESULTS I** and **RESULTS II** switches enable the categorized results to be displayed.

The available results depend on framing type, pattern synchronization, installed options, etc. Results that are *not available* display the message "UNAVAILABLE" in place of the result count. The results that are *not applicable* to the current mode display "N/A" in place of the result count. When the displayed count exceeds 99,999,999, a ">" (greater than sign) appears in the window. When the number rolls over, the count continues.

### 6.6.1 SUMMARY Category

The SUMMARY category automatically displays key results that are non-zero or out-of-specification. This allows quick access to the results without having to search through the other categories. The results that appear in the SUMMARY category include:

- BIT ERRORS (LOGIC category)
- SLIPS (LOGIC category)
- VIOLATIONS (BPV category)
- FRM ERRORS (FRAME category)
- CRC ERRORS (FRAME category)
- RX FREQ (SIGNAL category)

When all SUMMARY results are error-free, the message "ALL RESULTS OK" is displayed. When an error is detected, the appropriate test result appears in the SUMMARY category window. When more than one error is detected, press either the **RESULTS I Results** switch or **RESULTS II Results** switch to scroll through the results.

When the 310-9A Enhanced ESF/DS1 Timing Slips Option is installed and the PRM results are enabled, the following results can appear in the SUMMARY category. It should be noted that these results apply to the far-end received signal.

FAR BPV SEC (BPV category)
FAR FRM ES (FRAME category)
FAR FRM SES (FRAME category)
FAR SLIP SEC (FRAME category)
FAR CRC ERR (FRAME category)

The optional ESF datalink far-end Performance Report Message (PRM) results enable the 310-1 to monitor and report on the status of the ESF PRM as described in the ANSI T1.403-1989 standard. The far-end PRM results are available when either the ESF or ESFz operating mode is selected (see Section 6.3) and the PRM receiver auxiliary function is enabled (see Section 6.5.6). The PRM function determines whether the following PRM results are reported.

BPV Category
FAR BPV SEC — Far-End BPV Seconds

FRAME Category
FAR FRM ES — Far-End Frame Error Seconds
FAR FRM SES — Far-End Severely Errored Framing Seconds
FAR SLIP SEC — Far-End Controlled Slip Seconds
PAYLOAD SOURCE — Far-End Payload Source/Loopback
FAR CRC ERR — Far-End CRC Error Events

FCRC 1 — Far-End CRC 1 Bin
FCRC 2-5 — Far-End CRC 2 to 5 Bin
FCRC 6-10 — Far-End CRC 6 to 10 Bin
FCRC 11-100 — Far-End CRC 11 to 100 Bin
FCRC 101-319 — Far-End CRC 101 to 319 Bin
FCRC >319 — Far-End CRC 320 to 333 Bin

TIME Category
FAR PRM SEC — Far-End Performance Report Seconds

When a far-end PRM result count is an approximation because of a lost PRM, a "~" (tilde) precedes the result. The results are halted when the frame synchronization or the signal is lost during testing. When the FAR CRC ERR result is displayed and the indicated count is an approximation of the actual CRC error count, a ">" (greater than) sign precedes the count.

### 6.6.2 LOGIC Category

Logic errors are based on discrepancies between the transmitted and received bit stream. The accumulation of logic errors is dependent on frame synchronization (if in a framed mode) and pattern synchronization. Logic errors are not available until initial pattern synchronization is obtained. The results are also not available when sending loop codes. During loss of frame or pattern synchronization, the accumulation of errors is halted. The LOGIC category results are defined as follows:

**BIT ERRORS**
***Bit Errors*** — The number of received pattern bits which have a value opposite that of the corresponding transmitted bit pattern since initial DS1 pattern synchronization.

**BIT ERR RT**
***Bit Error Rate*** — The ratio of pattern bit errors to received pattern bits since initially acquiring pattern synchronization.

**ASYNC ERR SEC**
***Asynchronous Errored Seconds*** — The number of seconds during which one or more pattern bit errors occurred since initial DS1 pattern synchronization.

**SYNC ERR SEC**
***Synchronous Errored Seconds*** — The number of seconds during which at least one pattern bit error has occurred. Each second is initiated by, and synchronized to, a pattern bit error.

**%EFS**

***Bit, Percentage of Error-Free Seconds*** — The ratio, expressed as a percentage, of seconds during which no pattern bit errors were detected, to the total number of seconds while DS1 pattern synchronization is present.

**SYNC L SEC**

***Out-of-Synchronization Seconds*** — The number of seconds during which the receiver has lost pattern synchronization, even momentarily, since initial DS1 pattern synchronization.

**SEV ERR SEC**

***Severely Errored Seconds*** — The number of seconds during which the pattern bit error rate exceeded or equaled $10^{-3}$ b/s.

**CSES**

***Consecutive Severely Errored Seconds*** — The number of groups of three or more severely errored seconds.

**SLIPS**

***Slips*** — The number of times the received pattern becomes skewed relative to the expected (i.e., internally generated) test pattern. When a slip is detected, the 310-1 automatically resynchronizes to the received pattern. However, pattern bit errors are not suppressed during this process. Pattern slips are available only when using pseudorandom patterns.

The 310-10 G.821 Results Option enables the 310-1 to evaluate the long-term performance of your system. The option adds eight performance analysis results to the LOGIC category. Refer to Section 3.11.2 for a functional description of the G.821 results. The G.821 performance results are defined as follows:

**AVAIL SEC**

***Available Seconds*** — A count of elapsed seconds since pattern synchronization in which the bit error rate is less than $10^{-3}$.

**%AVAIL SEC**

***% Available Seconds*** — The ratio, expressed as a percentage, of available seconds to the total elapsed seconds since pattern synchronization.

**%SEV ER SEC**

***% Severely Errored Seconds*** — The ratio, expressed as a percentage, of severely errored seconds to the number of available seconds.

**DEG MIN**

***Degraded Minutes*** — A count of minutes during which the bit error ratio is worse than $10^{-6}$ and less than $10^{-3}$.

**%DEG MIN**

***% Degraded Minutes*** — The ratio, expressed as a percentage, of degraded minutes to the number of available minutes.

**UNAVAIL SEC**

***Unavailable Seconds*** — A count of elapsed seconds since pattern synchronization in which the bit error rate is greater than or equal to $10^{-3}$.

### 6.6.3 BPV Category

Bipolar violations are caused by successive DS1 pulses with the same polarity being detected (except those pulses that are part of the B8ZS encoding). Bipolar violation results are only accumulated when the signal is present. The BPV category results are defined as follows:

**VIOLATIONS**

***Bipolar Violations*** — The number of bipolar violations (BPVs) detected since the beginning of the test. Intentional B8ZS code violations are excluded from the count.

**BPV ERR RT**

***BPV Error Rate*** — The ratio of BPVs to received bits since initially acquiring signal presence.

**BPV ERR SEC**

***BPV Errored Seconds*** — The number of seconds during which one or more BPVs occurred since the beginning of the test.

**FAR BPV SEC**

***Far-End BPV Seconds*** — The number of seconds during which one or more BPVs occurred in the far-end received signal. This result reports on the PRM Line-Code Violation Event Bit (LV = 1) status. Requires the 310-9A Enhanced ESF/DS1 Timing Slips Option.

### 6.6.4 FRAME Category

Frame errors begin accumulating after initial frame synchronization on the incoming DS1 signal. For T1 circuits with ESF or ESFz framing, the 310-1 detects and accumulates CRC-6

errors which are used to calculate the CRC error rate and CRC errored seconds. The 310-1 only compiles the results that apply to the selected framing format. The available FRAME category results are defined as follows:

**FRM ERRORS**

***Frame Errors*** — The number of frame errors detected since initial DS1 frame synchronization.

**FRM ERR RT**

***Frame Error Rate*** — The ratio of frame errors to received framing bits since initially acquiring frame synchronization.

**FRM ERR SEC**

***Frame Errored Seconds*** — The number of seconds during which one or more frame errors occurred since initial DS1 frame synchronization.

**FRM SES**

***Frame Severely Errored Seconds*** — The number of seconds during which the total number of frame errors equals 12 or more (D4 framing only).

**FRM L SEC**

***Frame Loss Seconds*** — The number of seconds during which one or more frame synchronization losses occurred or during which frame synchronization could not be achieved, since initial DS1 frame synchronization.

**CRC ERRORS**

***Cyclic Redundancy Check Errors*** — The number of CRC errors detected since initial DS1 frame synchronization. CRC errors are counted only when ESF or ESFz framing is present in the received T1 data.

**CRC ERR SEC**

***Cyclic Redundancy Check Errored Seconds*** — The number of seconds during which one or more CRC errors occurred.

**CRC ERR RT**

***Cyclic Redundancy Check Error Rate*** — The ratio of CRC errors to the number of superframes received.

**CRC SES**

***Cyclic Redundancy Check Severely Errored Seconds*** — The number of seconds during which the total number of CRC errors and frame synchronization losses equaled 320 or more.

The following PRM test results require the 310-9A Enhanced ESF/DS1 Timing Slips Option.

**FAR FRM ES**

***Far-End Frame Error Seconds*** — The number of seconds during which one or more frame errors occurred in the far-end received signal. This result reports on the PRM Frame-Synchronization-Bit Error Event Bit (FE = 1) status.

**FAR FRM SES**

***Far-End Severely Errored Framing Seconds*** — The number of seconds during which two or more frame errors occurred in less than 3 ms in the far-end received signal. This result reports on the PRM Severely-Errored Framing Event Bit (SE = 1) status.

**FAR SLIP SEC**

***Far-End Controlled Slip Seconds*** — The number of seconds during which controlled slips occurred in the far-end received signal. This result reports on the PRM Controlled-Slip Event Bit (SL = 1) status.

**PAYLOAD SOURCE**

***Far-End Payload Source/Loopback*** — Identifies the direction of the PRM according to the PRM Command/Response Bit (C/R) and the Payload Loopback Activated Bit (LB). In end-to-end applications, a customer-generated PRM is indicated as CUST (C/R = 0 and LB = 0), and the carrier-generated PRM is indicated as CARR (C/R =1 and LB = 0) in the display. In payload loopback applications, the customer-generated PRM is indicated as CUST LOOP (C/R = 0 and LB = 1) when the customer is looped back, and the carrier-generated PRM is indicated as CARR LOOP (C/R = 1 and LB = 1) when the carrier is looped back.

**FAR CRC ERR**

***Far-End CRC Error Events*** — The minimum number of CRC errors reported in the following FCRC results. A">" (greater than) preceding the count indicates that the Bins 2 through 6 are non-zero. This result reports on the PRM CRC Error Event Bits (G1 to G6) status.

**FCRC 1**

***Far-End CRC 1 Bin*** — The number of seconds during which only one CRC error was reported in the far-end received signal. This result reports on the first PRM CRC Error Event Bit (G1 = 1) status.

**FCRC 2-5**

***Far-End CRC 2 to 5 Bin*** — The number of seconds during which 2 to 5 CRC errors were reported in the far-end received signal. This result reports on the second PRM CRC Error Event Bit (G2 = 1) status.

**FCRC 6-10**

***Far-End CRC 6 to 10 Bin*** — The number of seconds during which 6 to 10 CRC errors were reported in the far-end received signal. This result reports on the third PRM CRC Error Event Bit (G3 = 1) status.

**FCRC 11-100**

***Far-End CRC 11 to 100 Bin*** — The number of seconds during which 11 to 100 CRC errors were reported in the far-end received signal. This result reports on the fourth PRM CRC Error Event Bit (G4 = 1) status.

**FCRC 101-319**

***Far-End CRC 101 to 319 Bin*** — The number of seconds during which 101 to 319 CRC errors were reported in the far-end received signal. This result reports on the fifth PRM CRC Error Event Bit (G5 = 1) status.

**FCRC >319**

***Far-End CRC 320 to 333 Bin*** — The number of seconds during which 320 to 333 CRC errors were reported in the far-end received signal. This result reports on the sixth PRM CRC Error Event Bit (G6 = 1) status.

### 6.6.5 SIGNAL Category

The SIGNAL category results include signal level, frequency, and loss seconds. The results are accumulated after initial signal detection. The SIGNAL category results are defined as follows:

**SIG L SEC**

***Signal Loss Seconds*** — The number of seconds during which the received DS1 signal was lost for all or part of a second since initial signal detection.

**RX FREQ**

***Receive Frequency*** — The frequency of the clock recovered from the received data measured in Hz.

**RX LVL dBdsx**

***Receive Signal Level*** — The level of the received DS1 signal in dB relative to a standard 3-volt base-to-peak signal (DSX level).

**abcd**

***ABCD Channel Signaling Status*** — The result displays the channel signaling bits for all 24 DS0 channels in D4 or SLC-96 (A and B) and ESF or ZBTSI (A, B, C, and D) framing. Scrolling to this result causes the entire display (both lines) to show the signaling bit states for each DS0 channel. The signaling bits are displayed as shown. "N/A" appears in channels C and D when D4 or SLC- 96 framing is selected.

$$\begin{matrix} a_b & 1_0 1_0 1_0 1_0 1_0 1_0 1_0 & 1_0 1_0 1_0 1_0 1_0 1_0 1_0 & 1_0 1_0 1_0 1_0 1_0 1_0 1_0 & 1_0 1_0 1_0 1_0 1_0 1_0 1_0 1_0 \\ c_d & 1_0 1_0 1_0 1_0 1_0 1_0 1_0 & 1_0 1_0 1_0 1_0 1_0 1_0 1_0 & 1_0 1_0 1_0 1_0 1_0 1_0 1_0 & 1_0 1_0 1_0 1_0 1_0 1_0 1_0 1_0 \end{matrix}$$

**VF LVL dBm**

***Received Signal Level in dBm*** — The level of the average power in the currently selected DS0 channel (see **DS0 DROP CHANNEL** switch).

**TIMING SLIPS**

***DS1 Timing Slips*** — The number of bit slips and frame slips counted when the DS1 test signal slips (+ or -) from the DS1 reference signal after both signals are present simultaneously.

## Measuring DS1 Timing Slips

The timing slip measurement identifies frequency deviations which cause uncontrolled and controlled clock slips. A received DS1 test signal is compared to a DS1 reference signal. This comparison allows the 310-1 to count the number of test signal bits that move past the reference signal bit as illustrated in Figure 6-4.

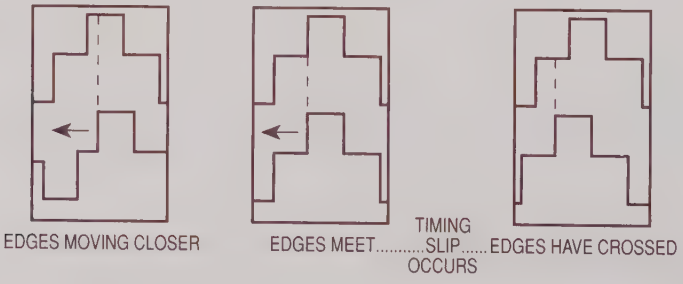



**Figure 6-4**
**DS1 Timing Slips**

The TIMING SLIPS result indicates frame slips and bit slips between the test signal and the reference signal.

**TIMING SLIPS**
**+xxxxfr +xxxbt**

The left number (+xxxxfr) indicates the frame slips and the right number (+xxxbt) indicates the bit slips. Both numbers also indicate the direction of the slip as positive (+) or negative (-). The bit slip result indicates bit slips from 0 to 192. When the 193rd bit slip is detected, the frame slip result is incremented by one and the bit slip count resets to zero.

The DS1 test signal is selected with the **DS1 SOURCE** switch and is taken from one of the following sources:

- **EXT. INPUT** — DS1 RECEIVE jack (310-1 DS1/DS0 Analyzer Option)
- **DS3 DROP** — PRIMARY DS3 RECEIVE jack
- **SONET DROP** — STS-1 RECEIVE jack or OC-1/3 RECEIVE connector (310-4/A SONET drop option)

The DS1 reference signal is selected with the SLIP REF auxiliary function and is taken from one of the following sources:

- DS1 RECEIVE jack (310-1 DS1/DS0 Analyzer Option)
- PRIMARY DS3 RECEIVE INPUT jack
- STS-1 RECEIVE jack (310-4 SONET Drop Option)
- OC-1/3 RECEIVE connector (310-4A SONET Drop Option)
- SECONDARY DS3 RECEIVE jack (310-3 DS1 Insert Option)
- DS1 INSERT INPUT jack (310-3 DS1 Insert Option)

When the same signal source is used, the TIMING SLIPS result indicates SAME REF (same reference). If either signal is lost after both signals are present simultaneously, the bit slip result resets to zero and the frame slip result is frozen. As long as either signal is missing, UNAVAILABLE remains in the result.

### 6.6.6 TIME Category

The TIME category lists current date, time, and timed results. The TIME category results are defined as follows:

**TIME**

***Current Time of Day*** — The current time of day in hours, minutes, and seconds. The time is set through the SET TIME auxiliary function (see Section 3.10.4).

**DATE**

***Current Date*** — The current day and month. The date is set through the SET DATE auxiliary function (see Section 3.10.4).

**ELAPSED TIME**

***Elapsed Time*** — The elapsed time in hours, minutes, and seconds since the last 310-1 test restart.

**TEST LENGTH**

***Timed Test Length*** — The currently set test length for a timed test in hours and minutes on the 310-1. The test length is set through the TEST LENGTH auxiliary function (see Section 3.10.4).

**TIME LEFT**

***Timed Test Time Left*** — The time remaining for a timed test in hours, minutes, and seconds on the 310-1.

**FAR PRM SEC**

***Far-End Performance Report Seconds*** — The number of total seconds, since test restart, during which a valid PRM was received. Requires the 310-9A Enhanced ESF/DS1 Timing Slips Option.

# SECTION 7
# DS1 INSERT

# DS1 INSERT OPTION

## 7.1 INTRODUCTION

This section describes the 310-3 DS1 Insert Option which allows the T-BERD 310 to insert a DS1 channel into a multiplexed DS3 signal. The option equips the T-BERD 310 with a secondary DS3 receiver and a DS1 receiver.

Figure 7-1 illustrates the signal flow when performing DS1 drop and insert testing. A DS1 signal is inserted into a selected channel of the secondary DS3 receive input. The DS1 signal can be sourced internally from the 310-1 DS1/DS0 Analyzer Option, or externally from the DS1 insert input. Once the DS1 channel is inserted into the DS3 signal, the full DS3 is transmitted into the network. The DS1 channel can then be looped back into the returning DS3 signal. This DS3 signal is then accepted by the primary DS3 receive input. The DS1 channel can then be dropped and analyzed by either the 310-1 DS1/DS0 Analyzer Option or by an external DS1 test set.

Additionally, the T-BERD 310 can perform dual DS3 signal monitoring by using the secondary DS3 receiver with the primary DS3 receiver. DS3 signal analysis can be performed simultaneously on both the primary and secondary DS3 input signals.

Appendix C shows the functional block diagram of the T-BERD 310 mainframe and the 310-3 DS1 Insert Option.

## 7.2 INSTRUMENT DESCRIPTION

The front-panel switches, indicators, displays, and connectors related to the operation of 310-3 DS1 Insert Option are described in the following sections.

### 7.2.1 Initial Test Setup

This section describes the following controls and indicators (see Figure 7-2) used to initially configure the T-BERD 310 to drop and insert a DS1 channel from a DS3 signal.

- **MODE** switch
- **PATTERN** switch

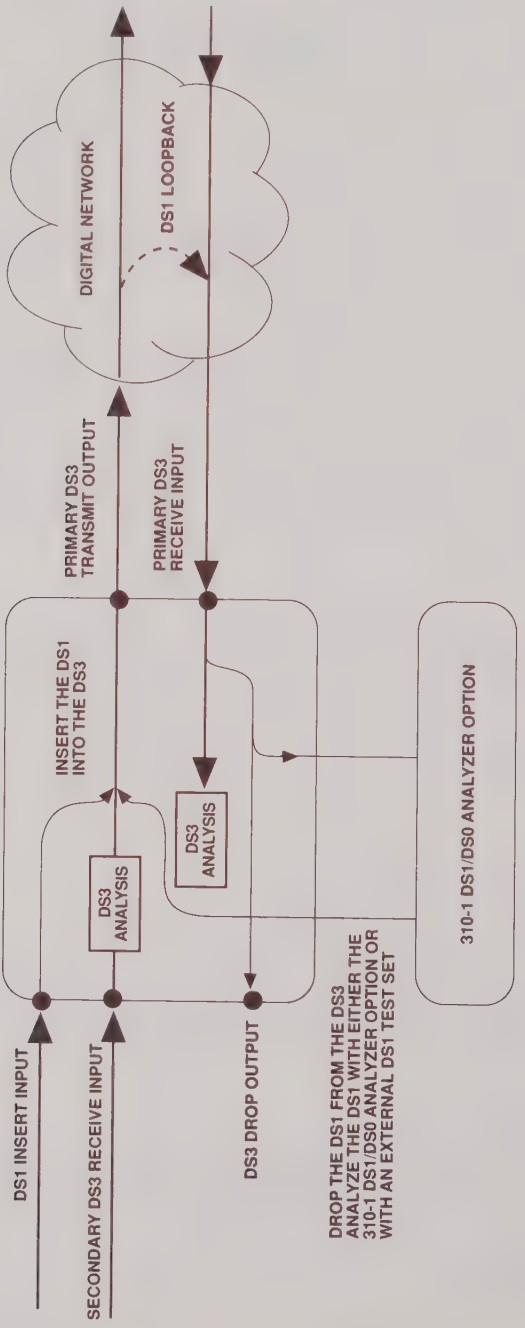



**Figure 7-1**
**DS1 Insert Option Signal Flow**

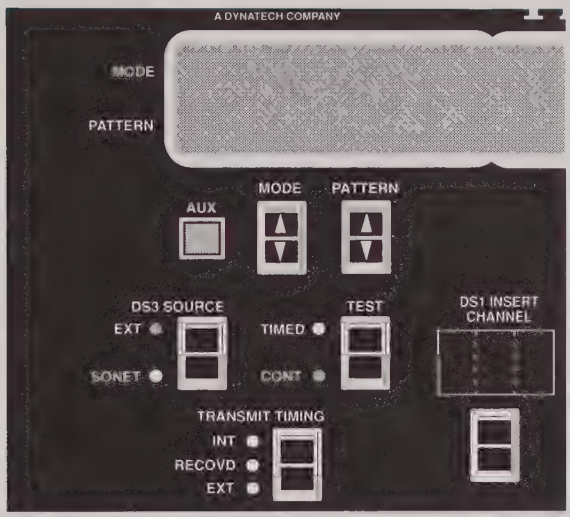



**Figure 7-2**
**Test Setup Controls and Indicators**

- **TRANSMIT TIMING** switch
- **DS1 INSERT CHANNEL** switch

**MODE switch —** Press the **MODE** switch to select the DS1 INSERT mode. The DS1 INSERT mode configures the T-BERD 310 to insert a DS1 channel into a secondary DS3 signal. Use the **PATTERN** switch to select the DS1 input source. The T-BERD 310 automatically configures itself to the received secondary DS3 framing.

**PATTERN switch —** Press the **PATTERN** switch to select the DS1 input source when the DS1 INSERT mode is selected. Select the DS1 input source from one of the following:

> ***EXTERNAL DS1 —*** Selects the side-panel DS1 INSERT INPUT jack as the source of the DS1 channel to be inserted into the DS3 signal from the SECONDARY DS3 RECEIVE jack.

***INTERNAL DS1*** — Selects the DS1 signal generated by the 310-1 as the source of the DS1 channel to be inserted into the DS3 signal from the SECONDARY DS3 RECEIVE jack. This selection is only available when the 310-1 is installed.

**TRANSMIT TIMING switch** — When the DS1 INSERT mode is selected, this switch defaults to RECOVD timing. The T-BERD 310 uses the secondary DS3 input signal as the recovered timing source.

**DS1 INSERT CHANNEL switch** — When in the DS1 INSERT mode, this switch selects the DS1 channel to be inserted into the secondary DS3 signal. Each time the **DS1 INSERT CHANNEL** switch is pressed, the channel number flashes for three seconds before the new selection takes affect. This allows the selection to be changed without affecting the test. The **DS1 INSERT CHANNEL** switch selections include:

***1 to 28*** — Select the inserted DS1 channel. The remaining 27 DS1 channels are not affected.

***— — — (triple dashes)*** — Select to pass the full secondary DS3 signal. No DS1 channels are inserted.

### 7.2.2 Test Connections

The 310-3 DS1 Insert Option adds two connections to the T-BERD 310: SECONDARY DS3 RECEIVE and DS1 INSERT INPUT jacks (see Figure 7-3). The front-panel DS3 connections provide access to the primary DS3 signal. The side-panel DS1 DROP jack provides access to the dropped DS1 signal.

**Input signal connections** — The following input signal connections are used to receive the primary and secondary DS3 signals and the DS1 channel.

***SECONDARY DS3 RECEIVE jack*** — This jack is located on the side panel. It allows a secondary DS3 signal to be analyzed and retransmitted from the PRIMARY DS3 TRANSMIT OUTPUT jack. In the DS1 INSERT mode, connect the secondary DS3 signal to the T-BERD 310 first. This allows the T-BERD 310 to synchronize to the secondary DS3 signal before connecting the T-BERD 310 output and interrupting the circuit under test. The jack can accept a DSX-3 or HIGH input level.

***DS1 INSERT INPUT jack*** — This jack accepts a DS1 channel to be inserted into the DS3 signal from the SECONDARY DS3 RECEIVE jack. The jack can accept a DSX-1 input level.

**Output signal connection** — The PRIMARY DS3 TRANSMIT OUTPUT jack retransmits the secondary DS3 signal containing the inserted DS1 channel.

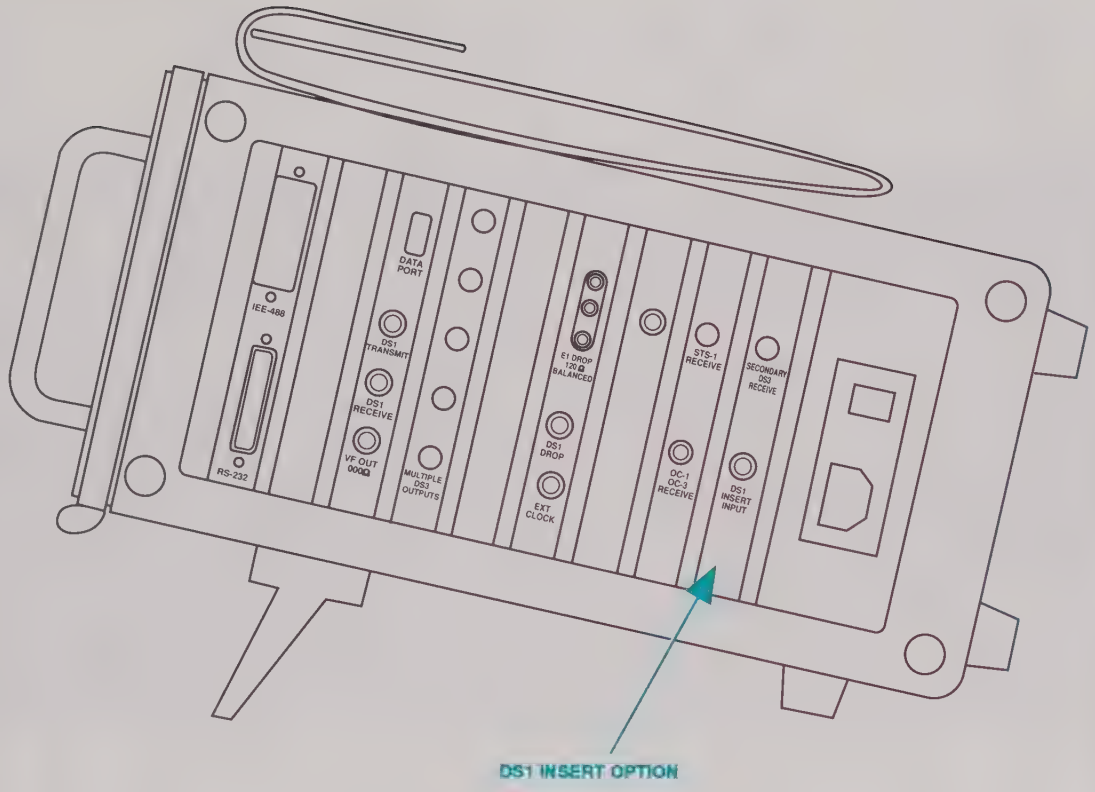



**Figure 7-3**
**DS1 Insert Option Connections**

### 7.2.3 Signal Verification

This section describes the following controls, indicators, and results used to verify that the T-BERD 310 has properly acquired the received secondary DS3 signal (see Figure 7-4).

- Secondary Status LEDs
- Secondary Alarm LEDs
- **RESULTS I** and **RESULTS II SECONDARY** switches
- Secondary SUMMARY category

**Secondary Status LEDs —** The green Secondary Status LEDs provide information about the current condition of the received secondary DS3 signal. The Secondary Status LEDs perform the same functions as described in Section 3.4.1 with the exception of the DS2 Frame Sync LED. The DS2 Frame Sync LED illuminates when the T-BERD 310 synchronizes to the DS2 framing format which corresponds to the inserted DS1 channel. The T-BERD 310 must be synchronized with the DS2 framing format before a DS1 signal can be inserted. If the received DS2 framing format is lost, the LED goes out, the DS2 Frame Loss LED illuminates, and the DS1 insertion is discontinued.

**Secondary Alarm LEDs —** The red Secondary Alarm LEDs provide information about the current and historical alarm conditions related to the received secondary DS3 signal. The Secondary Alarm LEDs perform the same functions as described in Section 3.4.2 with the exception of the DS2 Frame Loss LED. The DS2 Frame Loss LED illuminates when the T-BERD 310 loses DS2 frame synchronization which corresponds to the inserted DS1 channel. When the DS2 framing is detected again, the LED goes out and the associated History LED and DS2 Frame Sync LED illuminate.

**RESULTS I and RESULTS II SECONDARY switches —** Press either switch to select the Secondary DS3 results. The internal **SECONDARY** switch LED illuminates when the Secondary DS3 results are displayed. The SUMMARY, BPV, PARITY, FRAME, and SIGNAL categories are available when the **SECONDARY** switch is pressed. The Secondary SUMMARY category performs the same function as described in Section 3.4.3 except for the Secondary DS3 signal.

### 7.2.4 Starting and Running the Test

Press the **RESTART** switch to clear the old results and restart the test. Refer to Section 3.5 for more information on starting and running a test.

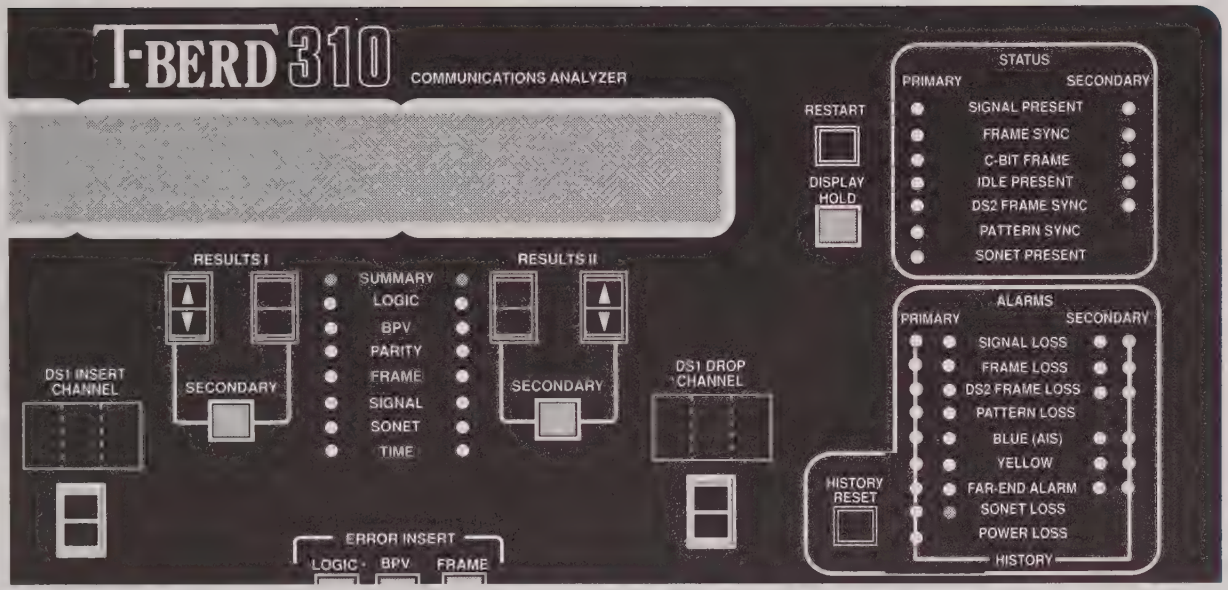



Figure 7-4
Secondary DS3 Signal Verification

### 7.2.5 Collecting Test Results

The Secondary DS3 category results are divided into five categories. They are only available when the **RESULTS I** or **RESULTS II SECONDARY** switch is illuminated. During the initial test set-up procedure, the SUMMARY category displays key results that are non-zero or out-of-specification. Refer to Section 3.6 for additional information on selecting and collecting the test results. When the Secondary DS3 signal is analyzed, the primary DS3 category results are also available (see Section 3.11). The available Secondary DS3 category results include:

**SUMMARY Category**

C-BIT ERRORS (PARITY Category)
PAR ERRORS (PARITY Category)
FEBE (PARITY Category)
FRM ERRORS (FRAME Category)
VIOLATIONS (BPV Category)
RX FREQ Hz (SIGNAL Category)
FEAC Messages (see Table 3-3)

**BPV Category**

VIOLATIONS — Bipolar Violations
BPV ERR RT — BPV Error Rate
AV BPV ERT — Average BPV Error Rate
BPV ERR SEC — BPV Errored Seconds
BPV %EFS — BPV, Percentage of Error-Free Seconds

**PARITY Category**

PAR ERRORS — Parity (P-bit) Errors
PAR ERR RT — Parity (P-bit) Error Rate
AV PAR ERT — Average Parity (P-bit) Error Rate
PAR ERR SEC — Parity (P-bit) Errored Seconds
PAR %EFS — Parity (P-bit), Percentage of Error-Free Seconds
C-BIT ERRORS — C-bit Parity Errors
C-BIT ERR RT — C-bit Parity Error Rate
AV C-BIT ERT — Average C-bit Parity Error Rate
C-BIT TYPE A — C-bit Parity Errored Seconds, Type A
C-BIT TYPE B — C-bit Parity Errored Seconds, Type B
C-BIT TYPE C — C-bit Parity Errored Seconds, Type C
C-BIT %EFS — C-bit Parity, Percentage of Error-Free Seconds
FEBE — Far-End Block Errors
FEBE RT — Far-End Block Error Rate
AV FEBE RT — Average Far-End Block Error Rate
FEBE TYPE A — Far-End Block Errored Seconds, Type A
FEBE TYPE B — Far-End Block Errored Seconds, Type B

FEBE TYPE C — Far-End Errored Seconds, Type C
FEBE %EFS — Far-End Block Error, Percentage of Error-Free Seconds

**FRAME Category**

FRM ERRORS — Frame Errors
FRM ERR RT — Frame Error Rate
AV FRM ERT — Average Frame Error Rate
FRM ERR SEC — Frame Errored Seconds
FRM %EFS — Frame, Percentage of Error-Free Seconds

**SIGNAL Category**

RX FREQ — Received Frequency in Hertz

### 7.2.6 Printing Test Results and Configurations

Secondary DS3 results are printed with the primary DS3 results. The secondary DS3 results can be customized through the CUSTOM auxiliary function. Press the **RESULTS I SECONDARY** switch to select the desired secondary DS3 results for the customized *results* printout. Refer to Section 3.7 and Section 4 for more information on printing the results. Refer to Appendix B for a list of alarm, status, and note messages that apply to the primary and secondary input signal analysis.

# SECTION 8
# SONET DROP

# SONET DROP OPTIONS

## 8.1 INTRODUCTION

This section describes the following SONET drop options.

- The 310-4 SONET Drop (STS-1) Option provides an STS-1 signal input and SONET overhead analysis capabilities. The STS-1 signal input is a WECO 560A jack.

- The 310-4A SONET Drop (STS-1, OC-1/3) Option provides an STS-1 signal input and an OC-1/3 signal input in addition to the SONET signal overhead analysis capabilities. The STS-1 signal input is a WECO 560A jack and the OC-1/3 signal input is a FC(PC) connector.

The SONET drop options enable the T-BERD 310 to receive Synchronous Optical Network (SONET) signals from an Synchronous Transport Signal - level 1 (STS-1), Optical Carrier - level 1 (OC-1), or Optical Carrier - level 3 (OC-3) signal. The T-BERD 310 can analyze the SONET signal overhead, DS3 payloads, and DS1 payloads. The DS1 payload can be dropped to either the 310-1 DS1/DS0 Analyzer Option or an external DS1 test set. Floating asynchronous and floating bit synchronous DS1 mapping formats are supported in both options.

Appendix C shows the functional block diagram of the T-BERD 310 mainframe and the SONET drop options.

## 8.2 INSTRUMENT DESCRIPTION

The front-panel switches, indicators, displays, and side-panel connectors related to the operation of a SONET drop option are described in the following sections.

### 8.2.1 Initial Test Setup

This section describes the following controls and indicators (see Figure 8-1) used to initially configure the T-BERD 310 to test from a SONET signal.

- **DS3 SOURCE** switch
- **AUX** switch

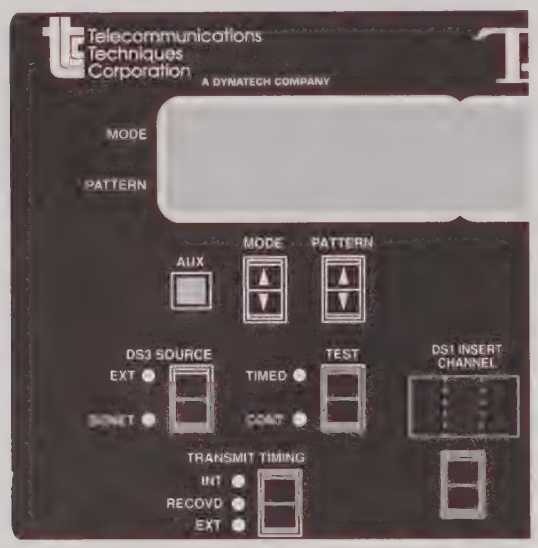



Figure 8-1
Test Setup Controls and Indicators

**DS3 SOURCE switch —** The **DS3 SOURCE** switch is used to select between a side-panel SONET input signal or the front-panel DS3 input signal. This allows either the SONET DS3 payload or the DS3 signal from the PRIMARY DS3 RECEIVE INPUT jack to be analyzed. The Primary Status and Alarm LEDs and results apply to the selected input signal. Press this switch to select the DS3 source:

***EXT* —** Selects the PRIMARY DS3 RECEIVE INPUT jack.

***SONET* —** Selects the side-panel STS-1 (OC-1/3) RECEIVE jack. If the 310-4A SONET Drop (STS-1,OC-1/3) Option is installed, the SONET input is selected from the SONET INPUT auxiliary function.

**AUX switch —** A SONET drop option adds the SONET auxiliary group to the mainframe auxiliary functions. The SONET auxiliary group contains the following functions:

***SONET INPUT* —** Selects the SONET input (STS-1, OC-1, or OC-3). This auxiliary function appears only when the 310-4A SONET Drop (STS-1,OC-1/3) Option is installed.

***DS1 DROP OUT*** — Selects the source (SONET or DS3) of the DS1 signal that is dropped to the side-panel DS1 DROP jack.

***SONET DS1 CH*** — Selects the DS1 channel (1 to 28) that is dropped from the SONET DS1 payload.

**NOTE:** The DS1 channel dropped from the SONET DS1 payload is selected with the SONET DS1 CH auxiliary function, *not* the **DS1 DROP CHANNEL** switch.

***STS RX LEVEL*** — Selects the receive level (DSX or HIGH) range for the STS-1 RECEIVE jack.

Refer to Section 8.3 for more information on the SONET auxiliary group. The mainframe auxiliary functions are described in Section 3.

### 8.2.2 Test Connections

The SONET drop options add one or two input connections to the T-BERD 310 (see Figure 8-2): STS-1 RECEIVE and OC-1/3 RECEIVE connections. The 310-4 SONET Drop (STS-1) Option provides a WECO 560A jack for the STS-1 signal input. The 310-4A SONET Drop (STS-1, OC-1/3) Option provides a WECO 560A jack for the STS-1 signal input and an FC(PC) optical connector for the OC-1/3 signal input. The front panel DS3 output and the side-panel DS1 drop output are also described in this section as they apply to SONET testing.

**Input signal connections** — The following input signal connections are used to receive either the STS-1 or OC-1/3 signal. When the **DS3 SOURCE** switch is set to SONET and no signal is present at the STS-1 (OC-1/3) RECEIVE jack, the dropped DS3 signal defaults to an unframed All Ones pattern.

***STS-1 RECEIVE jack*** — This jack allows an STS-1 signal to be connected to the T-BERD 310. The receiver can accept a DSX-3 or HIGH input level (see Section 8.3.4).

***OC-1/3 RECEIVE connector*** — This connector allows either an OC-1 or OC-3 signal to be connected to the T-BERD 310.

**Output signal connections** — The following output signal connections are used to drop out either a SONET DS3 or DS1 payload.

***PRIMARY DS3 TRANSMIT OUTPUT jack*** — In THRU mode (AUTO mode with "live" displayed), this jack can retransmit the SONET DS3 payload when the **DS3 SOURCE** switch is set to SONET.

**Figure 8-2**
**SONET Drop Option Connections**

***DS1 DROP jack*** — This jack drops the SONET DS1 payload when the DS1 DROP OUT auxiliary function is set to SONET.

### 8.2.3 Signal Verification

This section describes the following indicators and results used to verify that the T-BERD 310 has properly acquired the received SONET signal (see Figure 8-3).

- Primary Status LEDs
- Primary Alarm LEDs
- SUMMARY category

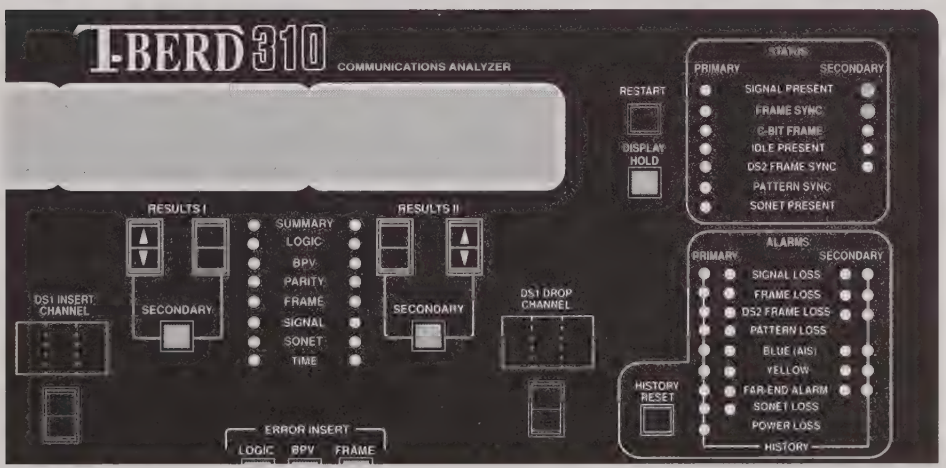



**Figure 8-3**
**SONET Signal Verification**

**Primary Status LEDs** — When the **DS3 SOURCE** switch is set to SONET, the green Primary Status LEDs provide information about the condition of the SONET DS3 payload. With the exception of the SONET Present LED, the Status LEDs perform the same functions as described in Section 3.4.1. The SONET Present LED illuminates when the T-BERD 310 detects a SONET signal. When the SONET signal is no longer detected, the SONET Present LED goes out and the SONET Loss LED illuminates.

**Primary Alarm LEDs** — When the **DS3 SOURCE** switch is set to SONET, the red Primary Alarm LEDs provide information about specific alarm conditions related to losing the SONET DS3 payload. With the exception of the SONET Loss LED, the Alarm LEDs perform the same function as described in Section 3.4.2. The SONET Loss LED illuminates when the SONET signal is no longer detected after initial signal detection. When the SONET signal is detected, the SONET Loss LED goes out and the associated History LED and SONET Present LED illuminate.

**SUMMARY category messages** — The SUMMARY category performs the same functions as described in Section 3.4.3. During initial acquisition of the received SONET signal, the SUMMARY category should be displayed. This provides key section, line, and path results on the received SONET signal. When an error is detected, the appropriate result appears in the displayed SUMMARY category (see Section 8.2.5).

### 8.2.4 Starting and Running the Test

Press the **RESTART** switch to clear the old results and restart the test. Refer to Section 3.5 for more information on starting and running a test.

### 8.2.5 Collecting Test Results

The SONET results are found in the SONET category (see Section 8.4 for descriptions). During the initial test setup procedure, the SUMMARY category displays key results that are non-zero or out-of-specification. Refer to Section 3.6 for additional information on selecting and collecting the results. When a SONET DS3 payload is analyzed, the primary DS3 category results are also available (see Section 3.11). When a SONET DS1 payload is analyzed, the DS1 signal can be analyzed from either the 310-1 DS1/DS0 Analyzer Option (see Section 6.6) or an external DS1 test set connected to the side-panel DS1 DROP jack. Refer to Section 8.4 for more information on SONET test results. The available categories include:

**SUMMARY category** — Lists key results that are non-zero or out-of-specification.

**LOGIC category** — Lists pattern bit error related results.

**BPV category** — Lists bipolar violation related results.

**PARITY category** — Lists P-bit, C-bit, FEBE, and parity error related results.

**FRAME category** — Lists DS3 and DS2 frame error related results.

**SIGNAL category** — Lists signal (frequency, level, and pulse shape) related results.

**SONET category** — Lists SONET overhead error, frame word error, and frequency related results.

**TIME category** — Lists time related results.

### 8.2.6 Printing Test Results and Configurations

SONET overhead results are printed with the primary DS3 results. The SONET overhead results can be customized through the CUSTOM auxiliary function. Refer to Section 3.7 and Section 4 for further information on printing the results. Refer to Appendix B for a list of alarm, status, and note messages that apply to the SONET input signal analysis.

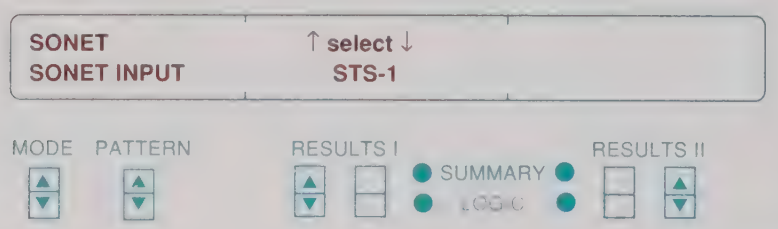
## 8.3 AUXILIARY FUNCTIONS

The following SONET auxiliary group is selected with the **AUX** switch. Table 8-1 lists the SONET auxiliary functions. Press the **AUX** switch to access the auxiliary functions. Press the **MODE, PATTERN, RESULTS I** and **RESULTS II** switches to manipulate the displayed auxiliary function (see Section 3.10).

**Table 8-1**
**SONET Auxiliary Group Functions**

| Function (PATTERN Switch) | Description |
|---|---|
| SONET INPUT | SONET Input Signal Source |
| DS1 DROP OUT | DS1 Drop Output Source |
| SONET DS1 CH | SONET DS1 Channel Select |
| STS RX LEVEL | STS Receive Level |

### 8.3.1 SONET INPUT — SONET Input Signal Source

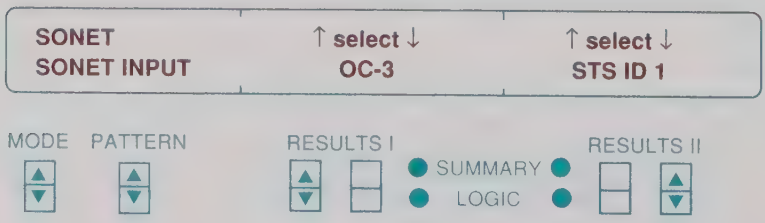



The SONET INPUT auxiliary function selects between the STS-1, OC-1, or OC-3 inputs. This auxiliary function is only available when the 310-4A SONET Drop (STS-1, OC-1/3) Option is installed. Press the **RESULTS I Results** switch to select one of the following SONET inputs:

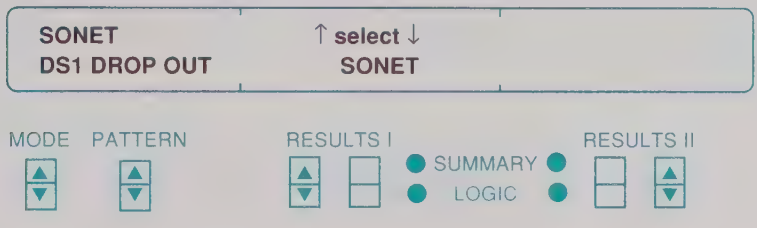
**STS-1** — This selection accommodates STS-1 signals from the side-panel STS-1 RECEIVE jack. Use the STS RX LEVEL auxiliary function to set the receive level.

**OC-1** — This selection accommodates OC-1 signals from the side-panel OC-1/3 RECEIVE connector.

**OC-3** — This selection accommodates OC-3 signals from the side-panel OC-1/3 RECEIVE connector. The STS ID auxiliary function appears in the RESULTS II window to select the STS-1 to be analyzed. Press the **RESULTS II Results** switch to select the STS ID number: 1, 2, or 3.



### 8.3.2 DS1 DROP OUT — DS1 Drop Output Source

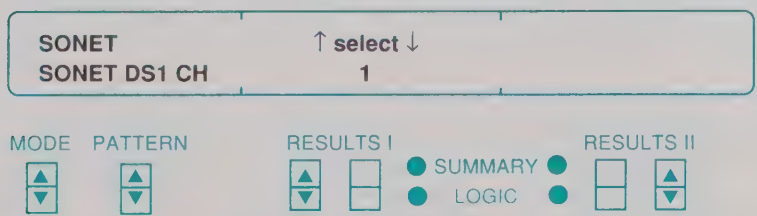



The DS1 DROP OUT auxiliary function selects the DS1 source for the side-panel DS1 DROP jack. Press the **RESULTS I Results** switch to select one of the following sources:

**DS3** — Selects the T-BERD 310 mainframe as the DS1 source. When the **DS3 SOURCE** switch is set to EXTERNAL, the DS1 channel is dropped from the DS3 signal received through the PRIMARY DS3 RECEIVE INPUT jack. When the **DS3 SOURCE** switch is set to SONET, the DS1 channel is dropped from the SONET DS1 payload received through the STS-1 (OC-1/3) RECEIVE jack.

**SONET** — Selects the SONET input as the DS1 source. This allows a DS1 channel to be dropped from the SONET DS1 payload received through the STS-1 (OC-1/3) RECEIVE jack. Select the dropped DS1 channel with the SONET DS1 CH auxiliary function.

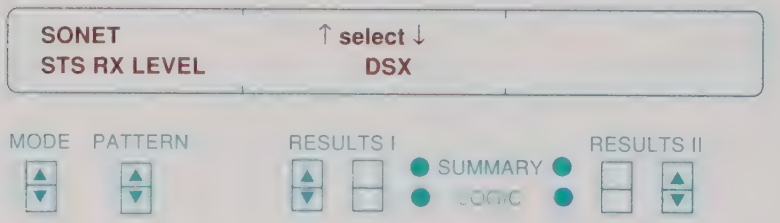
### 8.3.3 SONET DS1 CH — SONET DS1 Channel Select




The SONET DS1 CH auxiliary function selects the DS1 channel (1 to 28) to be dropped from the SONET DS1 payload. The DS1 channel can be dropped to either the 310-1 DS1/DS0 Analyzer Option (**DS1 SOURCE** switch set to SONET DROP) or the DS1 DROP jack (DS1 DROP OUT auxiliary function set to SONET). Press the **RESULTS I Results** switch to select DS1 channel from 1 to 28.

NOTE: The DS1 channel dropped from the SONET DS1 payload is selected with the SONET DS1 CH auxiliary function, *not* the **DS1 DROP CHANNEL** switch.

### 8.3.4 STS RX LEVEL — STS Receive Level




The STS RX LEVEL auxiliary function selects the input signal level range for the side-panel STS-1 RECEIVE jack. Press the **RESULTS I Results** switch to select either the DSX or HIGH range.

## 8.4 SONET TEST RESULTS

The SONET drop options enable the T-BERD 310 to analyze the SONET overhead and DS3 and DS1 payloads. Two results can be displayed at one time in the RESULTS I and RESULTS II windows. The **RESULTS I** and **RESULTS II** switches enable the categorized results to be displayed.

The available results depend on framing type, pattern synchronization, installed options, etc. Results that are *not available* display the message "UNAVAILABLE" in place of the result count. The results that are *not applicable* to the current mode display "N/A" in place of the result count. When the displayed count exceeds 99,999,999, a ">" (greater than sign) appears in the window. When the number rolls over, the count continues.

### 8.4.1 SUMMARY Category

The SUMMARY category automatically displays key results that are non-zero or out-of-specification. This allows quick access to the results without having to search through the other categories. The SONET results that appear in the SUMMARY category include:

- SECT BIP ERR — Section BIP Errors
- LINE BIP ERR — Line BIP Errors
- PATH BIP ERR — Path BIP Errors
- FRM WORD ERR — Frame Word Errors

When all SUMMARY results are error-free, the message "ALL RESULTS OK" is displayed. When an error is detected, the appropriate test result appears in the SUMMARY category window. When more than one error is detected, press either the **RESULTS I Results** switch or **RESULTS II Results** switch to scroll through the results.

### 8.4.2 SONET Category

The SONET results identify errored conditions with the SONET signal overhead which include section, line, and path Bit Interleave Parity (BIP) errors, frame word errors, errored seconds, pointer justification, automatic protection switching, and SONET frequency. The SONET category results are defined as follows:

**SECT BIP ERR**

***Section BIP Errors*** — The number of times the Section BIP indicates an error in the previous frame's section, line, path, and payload of the selected STS-1 since initial SONET frame synchronization.

**SECT BIP ES**

***Section BIP Errored Seconds*** — The number of seconds during which one or more Section BIP errors occurred in the STS-1 signal since initial SONET frame synchronization. The errored seconds interval is not synchronous to the occurrence of the BIP error.

**SECT BIP SES**

***Section BIP Severely Errored Seconds*** — The number of seconds which contain at least nine Section BIP errors occurring in the STS-1 or OC-1 signal, or 16 Section BIP errors in the OC-3 signal since initial SONET frame synchronization.

**LINE BIP ERR**

***Line BIP Errors*** — The number of times the Line BIP indicates an error in the previous frame's line, path, and payload of the selected STS-1 since initial SONET frame synchronization.

**LINE BIP ES**

***Line BIP Errored Seconds*** — The number of seconds during which one or more Line BIP errors occurred in the STS-1 signal since initial SONET frame synchronization. The errored seconds interval is not synchronous to the occurrence of the BIP error.

**LINE BIP SES**

***Line BIP Severely Errored Seconds*** — The number of seconds which contain at least 12 Line BIP errors occurring in the STS-1 signal since initial SONET frame synchronization.

**PATH BIP ERR**

***Path BIP Errors*** — The number of times the Path BIP indicates an error in the previous frame's path and payload of the selected STS-1 since initial SONET frame synchronization.

**PATH BIP ES**

***Path BIP Errored Seconds*** — The number of seconds during which one or more Path BIP errors occurred in the STS-1 signal since initial SONET frame synchronization. The errored seconds interval is not synchronous to the occurrence of the BIP error.

**PATH BIP SES**

***Path BIP Severely Errored Seconds*** — The number of seconds which contain at least nine Path BIP errors occurring in the STS-1 signal since initial SONET frame synchronization.

**FRM WORD ERR**

***Frame Word Errors*** — The number of times that the SONET frame words (A1 and A2) are in error for each STS-1 in an STS-N signal since initial SONET frame synchronization.

**SEV ERR FRM**

***Severely Errored Framing Seconds*** — The number of seconds which contain at least nine frame word errors occurring in the STS-1 or OC-1 signal, or 16 frame word errors in the OC-3 signal since initial SONET frame synchronization.

**POINTER JUST**

***Pointer Justification Counts*** — The number of times the Synchronous Payload Envelope (SPE) pointer changed since initial SONET frame synchronization.

**APS COUNTS**

***Automatic Protection Switch (APS) Counts*** — The number of times service is switched between the monitored SONET line and the SONET protection line.

**SONET FREQ**

***SONET Frequency*** — The result is the frequency of the clock recovered from the received SONET signal in Hz.

# SECTION 9
# E1 DROP

# E1 DROP OPTION

## 9.1 INTRODUCTION

The 310-2 E1 Drop Option enables the T-BERD 310 to drop an E1 channel from a DS3 signal to an external test set such as the TTC INTERCEPTOR 1402 Communications Analyzer. The 310-2 E1 Drop Option adds an E1 drop output connection on the T-BERD 310 side panel. Unless otherwise indicated in this section, the T-BERD 310 functions as described in Section 3.

## 9.2 INSTRUMENT DESCRIPTION

The front-panel switches, indicators, displays, and side-panel connectors related to the operation of the 310-2 E1 Drop Option are described in the following sections.

### 9.2.1 Initial Test Setup

This section describes the following controls and indicators (see Figure 9-1) used to initially configure the T-BERD 310 to test DS3 signals and drop out an E1 channel.

- **MODE** switch
- **DS1 DROP CHANNEL** switch

**MODE switch —** Select either the M13, C-BIT, AUTO, or THRU mode to drop an E1 signal. The received DS3 signal must have the proper DS2 Frame Alignment Sequence (FAS) to drop the E1 channel. The T-BERD 310 automatically senses the DS2 FAS. In this section the standard DS2 M-frame framing pattern is identified as "DS2 framing" and the DS2 M-frame framing pattern that contains E1 channels is identified as "DS2 FAS".

**DS1 DROP CHANNEL switch —** When a DS3 signal is received, the **DS1 DROP CHANNEL** switch can select either a DS1 or an E1 channel. The selected DS1 channel is dropped to the side-panel DS1 DROP jack and the selected E1 channel is dropped to the side-panel E1 DROP jack. The E1 channel number (E1 to E21) is displayed in the DS1 DROP CHANNEL window.

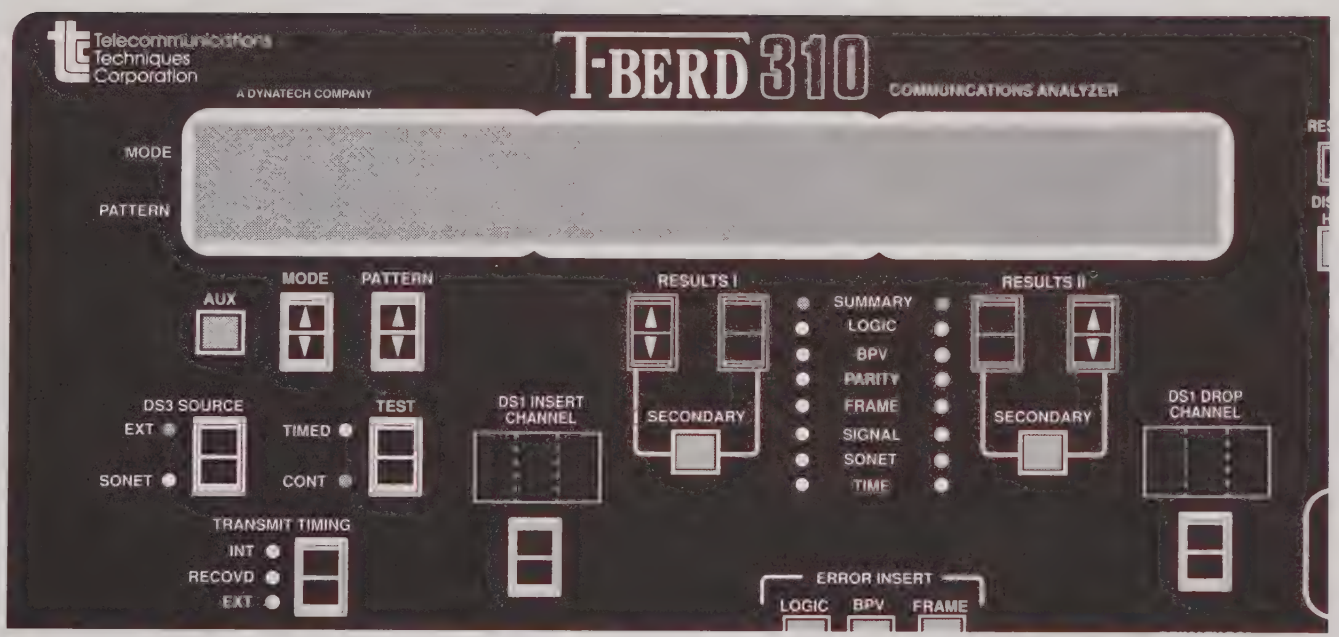



Figure 9-1
Test Set-Up Controls and Indicators

Table 9-1 shows how the DS1 and E1 channels are grouped by DS2 M-frames. As the DS1/E1 channel is selected from one DS2 M-frame to another, the T-BERD 310 automatically synchronizes to the appropriate DS2 framing pattern. The message "DS2 TEST RESTART" also appears in the MODE/PATTERN window when changing from one DS2 M-frame to another.

**Table 9-1**
**DS1 and E1 Channel Numbers**

| DS2 M-frames | DS1 Channel | E1 Channel |
|---|---|---|
| 1 | 1 | E1 |
| | 2 | E2 |
| | 3 | E3 |
| | 4 | |
| 2 | 5 | E4 |
| | 6 | E5 |
| | 7 | E6 |
| | 8 | |
| 3 | 9 | E7 |
| | 10 | E8 |
| | 11 | E9 |
| | 12 | |
| 4 | 13 | E10 |
| | 14 | E11 |
| | 15 | E12 |
| | 16 | |
| 5 | 17 | E13 |
| | 18 | E14 |
| | 19 | E15 |
| | 20 | |
| 6 | 21 | E16 |
| | 22 | E17 |
| | 23 | E18 |
| | 24 | |
| 7 | 25 | E19 |
| | 26 | E20 |
| | 27 | E21 |
| | 28 | |

If the DS3 signal contains both DS1 and E1 channels, the DS1 channels are displayed as "1" through "28" and the E1 channels are displayed as "E1" to "E21". When changing from one DS2 M-frame to another with alternating DS1 and E1 channels (by M-frame), the T-BERD 310 automatically senses the appropriate DS2 framing format and changes the channel number accordingly. For example, if the first DS2 M-frame has DS1 channels (1 to 4) and the second DS2 M-frame has E1 channels (E4 to E6), changing from DS1 channel 4 to 5 (see Table 9-1), would actually change the displayed channel from DS1 channel 4 to E1 channel E4.

### 9.2.2 Test Connections

The 310-2 E1 Drop Option adds the E1 DROP 3-pin banana jack to the side-panel DS1 DROP/EXT CLOCK slot (see Figure 9-2). The front-panel DS3 input provides the connection to receive the DS3 signal with the E1 channels.

**Input signal connections** — The PRIMARY DS3 RECEIVE INPUT jack provides the only input signal to drop an E1 signal. If a SONET drop option is installed, an E1 channel can be dropped from a SONET DS3 payload.

**Output signal connections** — The E1 DROP jack is the only output for E1 signals. This allows an external test set, such as the TTC INTERCEPTOR 1402 Communications Analyzer, to be connected to the T-BERD 310 to analyze the selected E1 channel dropped from the DS3 signal.

### 9.2.3 Signal Verification

This section describes the following indicators and results used to verify that the T-BERD 310 has properly acquired the received DS3 signal (see Figure 9-3) and dropped the E1 channel.

- Primary Status LEDs
- Primary Alarm LEDs
- Primary SUMMARY category
- DS1 DROP CHANNEL window

**Primary Status LEDs** — The Primary Status LEDs perform the same functions as described in Section 3 with the exception of the DS2 Frame Sync LED. The DS2 Frame Sync LED also illuminates when a valid DS2 FAS is detected.

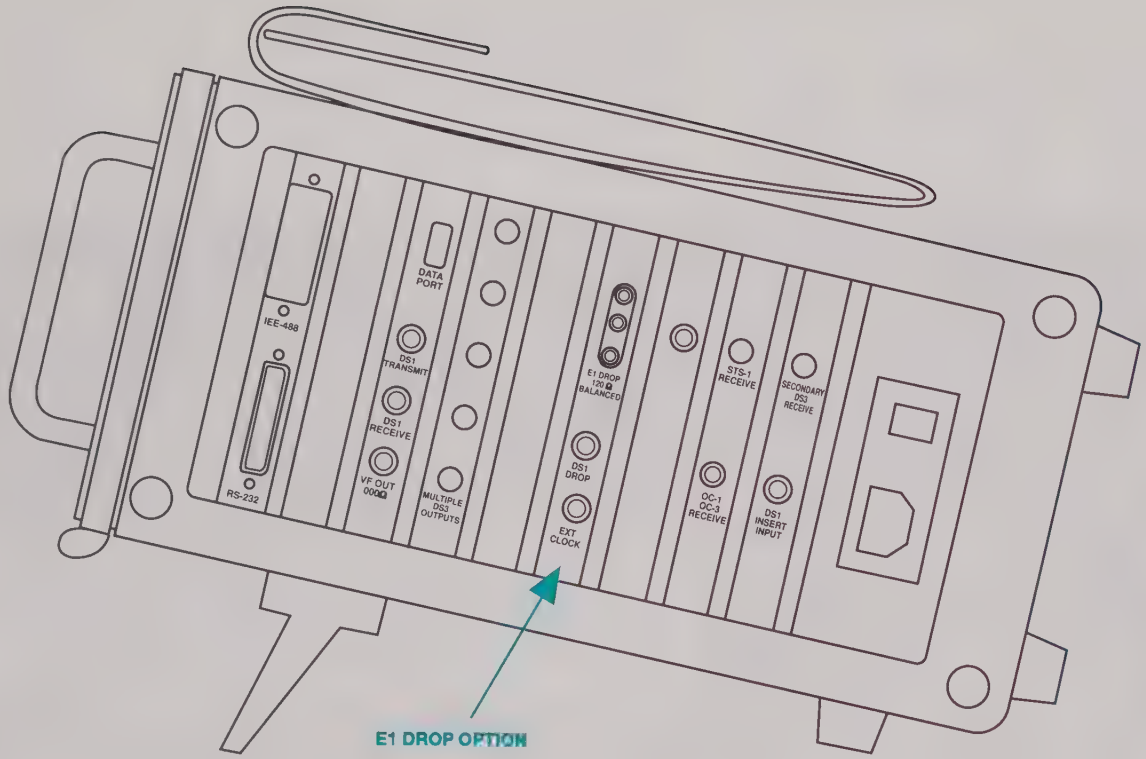



**Figure 9-2**
**E1 Drop Option Connection**

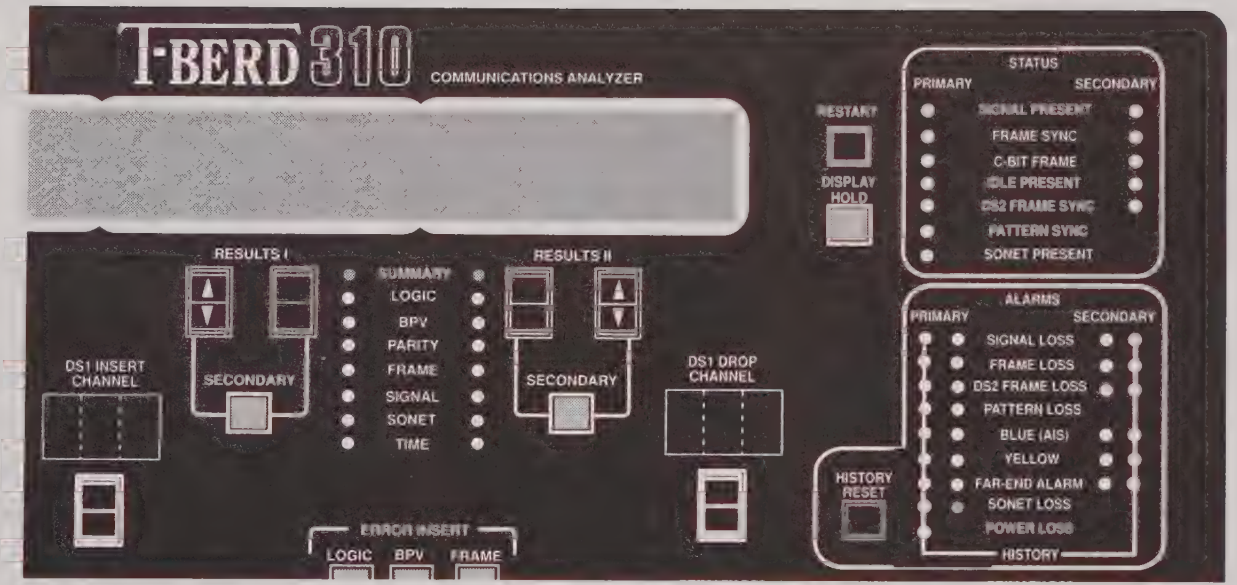



Figure 9-3
DS3 Signal Verification

**Primary Alarm LEDs —** The Primary Alarm LEDs perform the same functions as described in Section 3 with the exception of the DS2 Frame Loss LED. The DS2 Frame Loss LED illuminates when the DS2 FAS is lost. When DS2 framing is detected again, the LED goes out, and the associated History LED and the DS2 Frame Sync LED illuminate.

**SUMMARY category test results and messages —** The SUMMARY category performs the same functions as described in Section 3.4.3 for the DS3 signal analysis. During the initial acquisition of the received signal, the SUMMARY category should be displayed. This provides you with key results on the received DS3 signal when an error does occur.

**DS1 DROP CHANNEL window —** When the T-BERD 310 is synchronized to the DS2 FAS (DS2 Frame Sync LED illuminated), an "E" appears in front of the E1 channel number (E1 to E21). When the T-BERD 310 is synchronized to the DS2 framing (DS2 Frame Sync LED illuminated), the DS1 channel number appears (1 to 28).

### 9.2.4 Starting and Running the Test

Press the **RESTART** switch to clear the old results and restart the test. Refer to Section 3.5 for more information on starting and running a test.

### 9.2.5 Collecting the Test Results

The E1 signal test results and measurements must be made through an external test set, such as the TTC INTERCEPTOR 1402 Communications Analyzer. The DS3 signal test results should be checked to verify that the DS3 signal is functioning properly. When a DS3 signal is received with embedded E1 channels, the DS2 FRM ERR, DS2 FRM ERT, and DS2 AV F ERT results indicate DS2 FAS errors, not DS2 frame errors (see Section 3.11). Refer to Section 3.6 for additional information on selecting and collecting the results.

### 9.2.6 Printing Test Results and Configurations

The *results* printouts only apply to the T-BERD 310 DS3 results with the exception of the DS2 FRM ERR result as previously described. Refer to Section 3.7 and Section 5 for further information on printing the results at any time, at specific events, or manually. Refer to Appendix B for a list of alarm, status, and note messages that apply to the DS3 signal analysis.

# SECTION 10
# DS3 JITTER

# DS3 JITTER OPTION

## 10.1 INTRODUCTION

This section describes the 310-5 DS3 Jitter Option which allows the T-BERD 310 to measure wideband and highband jitter in the received DS3 signal. The option provides test results that measure the amplitude of the wideband and highband jitter in Unit Intervals (UIs). One UI equals (22.35 ns) the period of a DS3 44.736 MHz master clock. The option also provides a demodulated output that can drive a spectrum analyzer to determine the component amplitudes and frequencies of the jitter.

Appendix C shows the functional block diagram of the T-BERD 310 mainframe and the 310-5 DS3 Jitter Option. The DS3 Jitter Option measures the jitter from the PRIMARY DS3 RECEIVE INPUT signal only.

## 10.2 INSTRUMENT DESCRIPTION

The front-panel switches, auxiliary functions, indicators, displays, and side-panel connectors related to the operation of a 310-5 DS3 Jitter Option are described in the following sections.

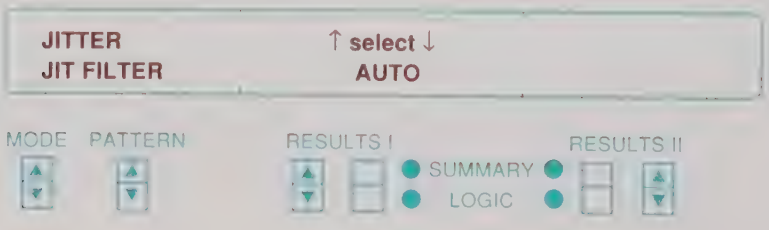
### 10.2.1 Initial Test Setup

DS3 jitter can be measured from the DS3 signal received through the PRIMARY DS3 RECEIVE INPUT jack. To obtain the most accurate jitter measurements, allow the T-BERD 310 to warm up for at least three minutes.

During the initial configuration of the T-BERD 310, the JITTER auxiliary functions should be checked and modified if required to measure the primary DS3 input signal for jitter.

Press the **AUX** switch to select the auxiliary functions, and press the **MODE** switch to select the JITTER auxiliary group. Press the **PATTERN** switch to select the following jitter auxiliary functions:

### JIT FILTER — Jitter Bandpass Filter Select



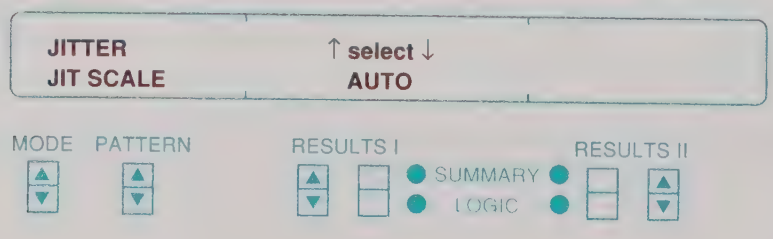

The JIT FILTER auxiliary function selects one of three jitter bandpass filter configurations to measure the jitter frequency. Press the **RESULTS I Results** switch to select one of the following filters:

**WIDEBAND** — Selects a wideband filter (10 Hz to 400 kHz). The HB JITTER and MAX HB JIT results are not available with this selection.

**HIGHBAND** — Selects a highband filter (30 kHz to 400 kHz). The WB JITTER and MAX WB JIT results are not available with this selection.

**AUTO** — Automatically sequences between the wideband and highband filters when measuring jitter. The JITTER OUTPUT jack is disabled with this selection.

### JIT SCALE — Jitter Amplitude Scale Select



The JIT SCALE auxiliary function selects one of four jitter amplitude scales to measure the jitter amplitude. Press the **RESULTS I Results** switch to select one of the following scales:

**2 UI p-p** — Selects the scale from 0 to 2.000 UI peak-to-peak.

**5 UI p-p** — Selects the scale from 0 to 5.00 UI peak-to-peak.

**20 UI p-p** — Selects the scale from 0 to 20.00 UI peak-to-peak.

**AUTO** — Automatically sets the scale to the measured amplitude. The JITTER OUTPUT jack is disabled with this selection.

### 10.2.2 Test Connections

The signal into the PRIMARY DS3 RECEIVE INPUT jack is the only DS3 input signal that can be tested for jitter.

The side-panel JITTER OUTPUT BNC connector provides a demodulated 1 Vp-p signal across a 50 ohm termination. The JIT FILTER auxiliary function controls the bandwidth of the JITTER OUTPUT signal. When either the JIT FILTER or JIT SCALE function is set to AUTO, the JITTER OUTPUT signal is disabled.

### 10.2.3 Signal Verification

The DS3 jitter measurements can only be obtained when a valid DS3 signal is received. The Primary Signal Present LED should be illuminated to verify that a valid DS3 signal is received. When the Primary Signal Loss LED is illuminated, the WB JITTER and HB JITTER results are not available. The MAX WB JIT and MAX HB JIT results are frozen by signal loss. Refer to Section 3.4 for more information on signal verification.

### 10.2.4 Starting and Running the Test

Press the **RESTART** switch to clear the old results and restart the test. Refer to Section 3.5 for more information on starting and running a test.

### 10.2.5 Collecting Test Results

The jitter amplitude results are found in the SIGNAL category and are dependent on the JITTER auxiliary group settings. Refer to Section 3.6 for additional information on selecting and collecting the other DS3 results. The SIGNAL category includes the following jitter results:

**WB JITTER**

***Wideband Jitter*** — The current wideband (10 Hz to 400 kHz) jitter amplitude, expressed in peak-to-peak UIs. This result is only available in the jitter AUTO and WIDEBAND filter modes.

**MAX WB JIT**

***Maximum Wideband Jitter*** — The maximum peak-to-peak wideband jitter amplitude, expressed in peak-to-peak UIs, since initial signal presence or test restart. This result is only available in the jitter AUTO and WIDEBAND filter modes. This result is unavailable if the WB JITTER result has been out of range since test restart. If the WB JITTER result is available and then goes "OUT OF RANGE", this result also goes "OUT OF RANGE" indicating the peak jitter reading is outside the current range.

**HB JITTER**

***Highband Jitter*** — The current highband (30 kHz to 400 kHz) jitter amplitude, expressed in peak-to-peak UIs. This result is only available in the jitter AUTO and HIGHBAND filter modes.

**MAX HB JIT**

***Maximum Highband Jitter*** — The maximum peak-to-peak highband jitter amplitude, expressed in peak-to-peak UIs, since initial signal presence or test restart. This result is only available in the jitter AUTO and HIGHBAND filter modes. This result is unavailable if the HB JITTER result has been out of range since test restart. If the HB JITTER result is available and then goes "OUT OF RANGE", this result also goes "OUT OF RANGE" indicating the peak jitter reading is outside the current range.

The message "UNAVAILABLE" appears in the result when the jitter option is initializing; after test restart; and in the AUTO mode when the T-BERD 310 is searching for the proper scale. When the combined frequency and amplitude exceed the selected hardware filter and scale, the message "OUT OF RANGE" appears in the result.

### 10.2.6 Printing Test Results and Configurations

The jitter results are printed with the primary DS3 results. Refer to Section 3.7 and Section 5 for further information on printing the results.

# SECTION 11
# SPECIFICATIONS

# SPECIFICATIONS

## 11.1 INTRODUCTION

This section contains the specifications for the T-BERD 310 Communications Analyzer.

## 11.2 GENERAL SPECIFICATIONS

### 11.2.1 Physical

| | |
|---|---|
| Dimensions: | 6.5" H x 14.0" W x 11.0" D (16.5 cm x 35.6 cm x 27.9 cm). |
| Weight: | 16.2 lbs. (7.3 kg), includes standard mainframe and lid. |

### 11.2.2 Environmental

| | |
|---|---|
| Operating Temperature Range: | 32°F to 122°F (0°C to 50°C). |
| Storage Temperature Range: | -40°F to 158°F (-40°C to 70°C). |
| Operating Humidity: | 90% maximum, noncondensing. |
| Storage Humidity: | 5% to 95% noncondensing. |
| Shock and Vibration: | Meets IEEE-743. |

### 11.2.3 Power

| | |
|---|---|
| Power: | 90 to 132 VAC from 47 to 63 Hz.<br>180 to 240 VAC from 47 to 63 Hz (factory installed option). |
| Fuse: | 5 A, 250 V, Slo-Blo, 5 x 20 mm (Littlefuse #218005 or equivalent). |

## 11.3 INPUT SPECIFICATIONS

### 11.3.1 DS3 Input

Input Level Range:

HIGH — Accepts a nominal signal level of 0.9 Vp (0 feet of cable attenuation from a HIGH source). With cable attenuation, accepts signal levels from +6 dB (-450 feet) of gain to -6 dB (450 feet) of loss from the nominal signal level (0.9 Vp). With resistive attenuation, accepts signal levels from +6 dB of gain to -26 dB of loss from the nominal signal level (0.9 Vp).

DSX — Accepts a nominal signal level of 0.5 Vp (450 feet of cable attenuation from a HIGH source). With cable attenuation, accepts signal levels from +6 dB (-450 feet) of gain to -6 dB (450 feet) of loss from the nominal signal level (0.5 Vp). With resistive attenuation, accepts signal levels from +6 dB of gain to -26 dB of loss from the nominal signal level (0.5 Vp).

LOW — Accepts a nominal signal level of 0.2 Vp (900 feet of cable attenuation from a HIGH source). With cable attenuation, accepts signal levels from +6 dB (-450 feet) of gain to -6 dB (450 feet) of loss from the nominal signal level (0.2 Vp). With resistive attenuation, accepts signal levels from +6 dB of gain to -20 dB of loss from the nominal signal level (0.2 Vp).

Input Jitter Tolerance:

The instrument meets or exceeds the mask specified in AT&T PUB 43802 and Bellcore TR-TSY-000009. For the 2^15-1 pattern, the mask is defined with a jitter amplitude of 5.0 UIp-p from 10 Hz to 2300 Hz, slope of -24 dB/decade from 2.3 kHz to 60 kHz, and an amplitude of 0.1 UIp-p from 60 kHz to 300 kHz.

### 11.3.2 External Clock Input

Input Connector:

Non-isolated, AC-coupled, 75-ohm BNC.

Input Frequency Range:

44.736 MHz ±300 ppm.

Input Amplitude:

1 Vp-p to 3 Vp-p.

## 11.4 OUTPUT SPECIFICATIONS

### 11.4.1 DS3 Output

| | |
|---|---|
| Output Connector: | Six WECO 560A jacks (one front panel and five side panel). Factory installed 358A jacks are also available. |
| Output Signal: | Internal Frequency — 44.736 MHz ±5 ppm. |
| Output Level Range: | HIGH — Nominal characteristics,<br>Pulse - rectangular.<br>Amplitude - 0.91 Vp ±1.2 dB.<br>Width (at 50% point) - 11.2 ns.<br>Rise and fall times (10% to 90% amplitude) - 4.5 ns.<br>Pulse resembles a DSX pulse after 450 feet of 728A coaxial cable.<br><br>DSX — Output signal level is approximately 0.5 Vp. Complies with CB 119, Table 8, and CCITT Recommendation G.703, Section 5. The signal level is equal to a HIGH signal sent through 450 feet of 728A coaxial cable.<br><br>LOW — Output signal level is approximately 0.2 Vp. The signal level is equal to a HIGH signal sent through 900 feet of 728A coaxial cable. |
| Line Code: | B3ZS. |
| Output Impedance: | 75 ohms nominal, unbalanced to ground. |

### 11.4.2 DS1 Drop Output

| | |
|---|---|
| Output Connector: | WECO 310 jack, side panel. |
| Pulse Shape: | With output terminated in 100-ohm resistive load, the T-BERD 310 meets pulse shape specifications given in CCITT Recommendation G.703; Bell Publications CB113, CB119, CB132, CB143, and PUB62508; and AT&T PUB62411. |
| Jitter Attenuation: | Meets or exceeds the jitter attenuation characteristics of AT&T PUB43802 and Bellcore TR-TSY-000191. |
| Line Code: | AMI or B8ZS (selectable). |

## 11.5 INPUT SIGNAL MEASUREMENTS

### 11.5.1 Power

An unframed All Ones pattern must be used to obtain an accurate power reading. The value is expressed in dBm and referenced across 75 ohms. 0 dBm corresponds to a DS3 signal level of approximately 0.39 Vp.

| | |
|---|---|
| Power Levels: | 10.0 to 13.4 dBm with an accuracy of ±2 dBm.<br>-12.0 to 9.9 dBm with an accuracy of ±1 dBm.<br>-26.0 to -12.1 dBm with an accuracy of ±2 dBm. |
| Resolution: | 0.1 dBm. |
| Range: | Less than -26.0 to +13.4 dBm. |

### 11.5.2 Frequency

| | |
|---|---|
| Accuracy: | ±2 ppm. |
| Resolution: | 10 Hz. |
| Range: | 44.736 MHz ±1.5 MHz. |

### 11.5.3 Level

The maximum peak voltage of the received signal is measured.

| | |
|---|---|
| Level Accuracy: | 1.2 to 1.8 Vp with an accuracy of ±0.2 V.<br>0.80 to 1.1 Vp with an accuracy of ±0.1 V.<br>0.25 to 0.79 Vp with an accuracy of ±0.03 V.<br>0.00 to 0.24 Vp with an accuracy of ±0.02 V. |
| Level Resolution: | 0.00 to 1.99 Vp with a resolution of 0.01 V. |
| Range: | 0.00 to 1.99 Vp. |

## 11.6 ALARM CRITERIA

| | |
|---|---|
| Signal Loss: | 0.02 ms without valid input pulses. |
| Frame Loss: | 3 OUT OF 15 — 3 out of 15 F-bits in error, or 2 out of 3 010 M-bit sequences in error.<br>6 OUT OF 15 — 6 out of 15 F-bits in error. |
| DS2 Frame Loss: | 2 out of 4 DS2 F-bit errors. Occurs when the DS2 corresponding to the selected DS1 drop channel loses frame synchronization. |
| Pattern Loss: | FAST — 1024 errors per 32,767 data bits.<br>SLOW — 250,000 errors per 1,000,000 bits. |
| Blue (AIS): | STUCK C-BIT — valid framing, valid parity, all stuffing indicator C-bits equal zero, and the 1010 criteria.<br>1010 — 30 msec of 1010 pattern with framing. |
| Yellow: | Both X-bits = 0. |
| Far-End Alarm: | Receipt of valid far-end alarm message (not loop codes) through the third C-bit in subframe 1 (FEAC-bit). |
| SONET Loss: | Receipt of four consecutive errored frames. |

## 11.7 PULSE SHAPE CRITERIA

| | |
|---|---|
| ANSI: | T1.102-1991, Figure 5. |
| CCITT: | Proposed CCITT G.703, Figure 14/G.703. |

## 11.8 PATTERN SPECIFICATIONS

### 11.8.1 Non-Channelized Test Pattern Definitions

| | |
|---|---|
| 2^23-1: | Pseudorandom pattern with length of $2^{23}$-1 bits. This pattern conforms with CCITT Recommendation O.151. |
| 2^20-1: | Pseudorandom pattern with length of $2^{20}$-1 bits. This pattern conforms with Bell Compatibility Bulletin No. 114. |
| 2^15-1: | Pseudorandom pattern with length of $2^{15}$-1 bits. This pattern conforms with CCITT Recommendation O.151. |
| 1111: | Fixed pattern consisting of marks only. |
| 1100: | Fixed pattern of two marks followed by two spaces. In framed mode, the pattern is synchronized to the framing bits. In addition, C-bits are changed to indicate M13 or C-bit parity Idle Signal as described in the ANSI T1.107-1990 standard. |
| 1010: | Fixed pattern of one mark and one space. In framed mode, the pattern is synchronized to the framing bits. When either M13 or C-bit parity framing is on, this is equivalent to sending a Blue Signal. All C-bits are set to zero to indicate stuck C-bits and the FID-bit is set to zero as described in the ANSI T1.107-1990 standard. |
| USER1: | 3- to 24-bit programmable pattern. Factory default: 10000. |

### 11.8.2 Channelized Test Pattern Definitions

| | |
|---|---|
| T1D4 1:7: | F01000000.... Pattern is aligned with the T1 D4 framing (F) format as indicated. |
| T1D4 QRSS: | $2^{20}$-1 bit pseudorandom pattern with 14-zero suppression and T1 D4 framing. |
| T1D4 3/24: | F0100 0100 0000 0000 0000 0100.... Pattern is aligned with the T1 D4 framing (F) format as indicated. |

T1D4 1004Hz: 1004 Hz tone on all DS0s with T1 D4 framing. The tone is phase shifted between adjacent DS0 channels to prevent Yellow Alarms.

T1ESF 1:7: F01000000.... Pattern is aligned with the T1 ESF framing (F) format as indicated.

T1ESF QRSS: $2^{20}$-1 bit pseudorandom pattern with 14-zero suppression and T1 ESF framing.

T1ESF 3/24: F0100 0100 0000 0000 0000 0100.... Pattern is aligned with the T1 ESF framing (F) format as indicated.

T1ESF 1004Hz: 1004 Hz tone on all DS0s with T1 ESF framing.

### 11.8.3 Pattern Synchronization Acquisition Criteria

Pseudorandom Patterns: 60 + n consecutive error-free bits for pattern length $2^n$ - 1.

Fixed Patterns: 64 consecutive error-free bits.

## 11.9 FRAME SYNCHRONIZATION DETECTION CRITERIA

Frame Sync: 15 consecutive error-free F-bits and 2 consecutive error-free $M_0$ $M_1$ $M_0$ sequences.

## 11.10 DS3 M13 FRAMING FORMAT

The DS3 M13 frame consists of seven subframes each with eight overhead bits. There are 84 data bits between each of the overhead bits. The DS3 overhead bits are shown in Table 11-1.

Table 11-1
DS3 M13 Overhead Bits

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| subframe 1 | X | $F_1$ | $C_{11}$ | $F_0$ | $C_{12}$ | $F_0$ | $C_{13}$ | $F_1$ |
| subframe 2 | X | $F_1$ | $C_{21}$ | $F_0$ | $C_{22}$ | $F_0$ | $C_{23}$ | $F_1$ |
| subframe 3 | P | $F_1$ | $C_{31}$ | $F_0$ | $C_{32}$ | $F_0$ | $C_{33}$ | $F_1$ |
| subframe 4 | P | $F_1$ | $C_{41}$ | $F_0$ | $C_{42}$ | $F_0$ | $C_{43}$ | $F_1$ |
| subframe 5 | $M_0$ | $F_1$ | $C_{51}$ | $F_0$ | $C_{52}$ | $F_0$ | $C_{53}$ | $F_1$ |
| subframe 6 | $M_1$ | $F_1$ | $C_{61}$ | $F_0$ | $C_{62}$ | $F_0$ | $C_{63}$ | $F_1$ |
| subframe 7 | $M_0$ | $F_1$ | $C_{71}$ | $F_0$ | $C_{72}$ | $F_0$ | $C_{73}$ | $F_1$ |

$F_1 F_0 F_0 F_1 = 1001$: Frame Alignment Bits.

$M_0 M_1 M_0 = 010$: Multiframe Alignment Bits.

XX = 00 or 11: User-Defined - X-bits must be the same in a given frame and they should not change more than once a second.

PP = 00 or 11: Parity Bits - Parity is calculated over the preceding frame of 4704 data bits. Parity equals 11 if the number of marks is odd and 00 if the number of marks is even.

$C_{n1} C_{n2} C_{n3}$ = 000 or 111: Stuff Indicator Bits - The 21 stuff indicator bits are all the same for a given frame and follow an 18-frame pattern: 001 001 001 001 001 011. When transmitting a Blue Signal, the C-bits are all set to zero. Note that if the MUXED M13 or MUXED C-BIT mode is being used, the indicator bits are set to allow proper stuffing rates for the embedded DS1 signals.

## 11.11 DS3 C-BIT FRAMING FORMAT

C-bit framing is the same as DS3 M13 framing, except all C-bits are redefined and used to do more extensive performance monitoring. No stuff bits are used because the DS3 C-bit framing format is synchronous. The X-bits are also given a more specific definition. The framing, multiframing, and parity bits are the same as the definitions within the DS3 M13 framing format. Table 11-2 describes the C-bit overhead bits.

**Table 11-2**
**DS3 C-Bit Overhead Bits**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| subframe 1 | X | $F_1$ | FID | $F_0$ | $N_a$ | $F_0$ | FEAC | $F_1$ |
| subframe 2 | X | $F_1$ | $DL_a$ | $F_0$ | $DL_a$ | $F_0$ | $DL_a$ | $F_1$ |
| subframe 3 | P | $F_1$ | CP | $F_0$ | CP | $F_0$ | CP | $F_1$ |
| subframe 4 | P | $F_1$ | FEBE | $F_0$ | FEBE | $F_0$ | FEBE | $F_1$ |
| subframe 5 | $M_0$ | $F_1$ | $DL_T$ | $F_0$ | $DL_T$ | $F_0$ | $DL_T$ | $F_1$ |
| subframe 6 | $M_1$ | $F_1$ | $DL_a$ | $F_0$ | $DL_a$ | $F_0$ | $DL_a$ | $F_1$ |
| subframe 7 | $M_0$ | $F_1$ | $DL_a$ | $F_0$ | $DL_a$ | $F_0$ | $DL_a$ | $F_1$ |

FID = 1: Format Identification Bit is always one to indicate C-bit parity framing. If more than 4 out of 16 zeros at this bit are detected, regular bit framing is assumed.

XX = 00 or 11: Used to transmit a near-end out-of-frame condition to the far-end. X-bits must be the same in a given frame and should not change more than once a second.

PP = 00 or 11: Parity Bits – Parity is calculated over the preceding frame of 4704 data bits. Parity equals 11 if the number of marks is odd and 00 if the number of marks is even.

$N_a$: Reserved Network Application Bit.

FEAC: Far-End Alarm and Control Channel.

$DL_a$: Application Specific Datalink Bits.

$DL_T$: Terminal-to-Terminal Path Maintenance Datalink Bits - currently not available.

CP = 000 or 111: C-Bit Parity Bits – Same as parity bits (PP), but C-bit parity (CP) allows end-to-end performance monitoring. CP-bits are not recalculated at every facility as parity bits are. Majority voting among the three CP-bits determines parity.

FEBE = 000 or 111: Far-End Block Errors are generated when a C-bit parity or framing error is detected. FEBE = 111 indicates no errors. FEBE ≠111 indicates error(s). Majority voting among the three FEBE bits is *not* used to declare a far-end block error.

## 11.12 RS-232 INTERFACE CONNECTOR

Connector Pin Assignments: See Table 11-3.

**Table 11-3**
**RS-232 Connector Pin Assignments**

| Pin # | Designation | Direction | Description |
|---|---|---|---|
| 1 | Prot. Gnd | — | Protective Ground — Connected to chassis ground. |
| 2 | TD | IN | Transmitted Data — The T-BERD 310 receives data on this lead. |
| 3 | RD | OUT | Received Data — The T-BERD 310 transmits data on this lead. |
| 5 | CTS | OUT | Clear to Send — This lead is asserted by the T-BERD 310 when it is ready to receive data. It should be monitored by the DTE to avoid transmitting data too fast to the T-BERD 310. |
| 6 | DSR | OUT | Data Set Ready — This lead is always ON when power is applied. |
| 7 | Sig. Gnd | — | Signal Ground — Connected to signal ground. |
| 8 | + VDC | — | Test Voltage — This lead provides +12 VDC (RS-232 ON). |
| 9 | + VDC | — | Test Voltage — This lead provides +12 VDC (RS-232 ON). |
| 10 | - VDC | — | Test Voltage — This lead provides -12 VDC (RS-232 OFF). |
| 12 | SRLSD | OUT | Secondary Received Line Signal Detector — This lead is driven ON by the T-BERD 310 when data is being sent. |
| 20 | DTR | IN | Data Terminal Ready — When this lead is asserted by the receiving device (e.g., printer), the T-BERD 310 transmits data. |

| | |
|---|---|
| Character Format: | Seven or eight data bits (ASCII coding). Even or odd parity. Two transmitted stop bits. Accepts one or more received stop bits. |
| Baud Rates: | 110, 300, 600, 1200, 2400, 4800, and 9600. |
| Terminator: | CR, LF, and CRLF. |
| Print Width: | 40-column or 80-column. |
| Connector Configuration: | DCE. |
| Connector: | 25-pin female D. |

## 11.13 GROUNDING

| | |
|---|---|
| Chassis and Signal Grounds: | Connected internally. |
| WECO 560A Jack Sleeves: | Connected to chassis ground. |
| Power Cord: | Center ground pin connected to chassis ground. |
| 25-pin D Connector: | Pin 1 to chassis ground.<br>Pin 7 to signal ground. |

## 11.14 310-1 DS1/DS0 ANALYZER OPTION SPECIFICATIONS

This section contains the specifications for the 310-1 DS1/DS0 Analyzer Option.

### 11.14.1 Environmental

| | |
|---|---|
| Operating Temperature Range: | 32°F to 122°F (0°C to 45°C). |

| | |
|---|---|
| Storage Temperature Range: | -40°F to 158°F (-40°C to 70°C). |
| Operating Humidity: | 90% maximum, noncondensing. |
| Storage Humidity: | 5% to 95% noncondensing. |

### 11.14.2 T1 Input

| | |
|---|---|
| Connector: | WECO 310 jack. |
| Frequency: | 1,544,000 Hz ±1000 Hz. |
| Impedance: | BRIDGE — 1000 ohms or greater.<br>TERM — 100 ohms ±5%.<br>DSX-MON — 100 ohms ±5%. |
| Operating Range: | BRIDGE — +6 to -35 dBdsx cable loss.<br>TERM — +6 to -35 dBdsx cable loss.<br>DSX-MON — +6 to -24 dBdsx resistive loss. |
| Line Code: | AMI or B8ZS. Received B8ZS is automatically decoded. |
| Jitter Tolerance: | per AT&T PUB62411, 1985. |
| T1 Framing Formats: | D4 Superframe, ESF, ESFz (optional), SLC-96, and Unframed. |

### 11.14.3 T1 Output

| | |
|---|---|
| Connector: | WECO 310 jack. |
| Signal Level: | 3 V base-to-peak into a 100-ohm load (0 dBdsx). |
| Pulse Shape: | With the output terminated into a 100-ohm resistive load (DSX-MON), the 310-1 meets pulse shape specifications given in CCITT Recommendation G.703; Bell Publications CB113, CB119, CB132, CB143, and AT&T PUB62508; and AT&T PUB62411. |
| Internal Oscillator Accuracy: | ±5 ppm. |

| | |
|---|---|
| Line Code: | AMI or B8ZS. |
| T1 Framing Formats: | D4 Superframe, ESF, ESFz (optional), SLC-96, and Unframed. |

### 11.14.4 Alarm Criteria

| | |
|---|---|
| Signal Loss: | 150 ms without input pulses after initial signal detected. |
| Pattern Sync Loss: | QRSS, $2^{15}$-1, $2^{20}$-1, and $2^{23}$-1 — 250 errors in 1000 or fewer bits.<br>1:1, 1:7, ALL ONES, 3 IN 24, and USER1 — 100 errors in 1000 or fewer bits. |
| Frame Sync Loss: | D4 — two out of five Ft bits in error.<br>ESF — two out of five frame bits in error.<br>SLC — two out of four Ft bits in error. |
| Excess Zeros: | 16 or more consecutive zeros with AMI line coding.<br>8 or more consecutive zeros with B8ZS line coding. |
| Yellow Alarm: | D4 and SLC — Bit 2 is a "0" for 255 consecutive channels.<br>ESF — 256 bits ±16 bits of repetitive 11111111 00000000 pattern received in the datalink. |
| All Ones: | Unframed — 2048 or more consecutive ones.<br>Framed — 256 consecutive DS0 channels with all ones. |

### 11.14.5 Test Pattern Definitions

| | |
|---|---|
| 1:1: | Alternating ones (mark) and zeros (space) pulses. |
| 1:7: | F01000000.... A single one and seven zeros pattern. When framed, the pattern is aligned with the F-bits as indicated to prevent false Yellow Alarms. |
| 2^15-1: | 32,767-bit pseudorandom pattern generates a maximum of 14 sequential zeros and 15 sequential ones. |
| 2^20-1: | 1,048,575-bit pseudorandom pattern generates a maximum of 19 sequential zeros and 20 sequential ones. |

| | |
|---|---|
| 2^23-1: | 8,388,607-bit pseudorandom pattern generates a maximum of 22 sequential zeros and 23 sequential ones. |
| 3 IN 24: | F0100 0100 0000 0000 0000 0100. Pattern synchronized to framing bits to prevent D4 Yellow Alarms or Excess Zeros. |
| ALL ONES: | All Ones (marks). |
| QRSS: | Quasi-Random Signal Source. Modified $2^{20}$-1 pseudorandom pattern which generates a maximum of 14 sequential zeros and 20 sequential ones. |
| USER1: | 3- to 24-bit programmable pattern; factory setting is 10000. |

### 11.14.6 Pattern Sync Detection Criteria

| | |
|---|---|
| Fixed Patterns: | 30 consecutive error-free bits. |
| Pseudorandom Patterns: | 30 + n consecutive error-free bits for a pattern length of $2^n$-1 (for QRSS, n = 20). |

### 11.14.7 Loop Code Pattern Definitions

| | |
|---|---|
| In-band Loop Codes: | CSU — Loop up: 10000. Loop down: 100.<br>FACILITY 1 — Loop up: 1100. Loop down: 1110.<br>FACILITY 2 — Loop up: 11000. Loop down: 11100.<br>PROGRAMMABLE — 3- to 8-bit programmable pattern for both loop codes. |
| ESF Out-of-Band Loop Codes: | LINE — Loop up: 1111 1111 0111 0000. Loop down: 1111 1111 0001 1100.<br>PAYLOAD — Loop up: 1111 1111 0010 1000. Loop down: 1111 1111 0100 1100.<br>NETWORK — Loop up: 1111 1111 0100 1000. Loop down: 1111 1111 0010 0100. |

### 11.14.8 Loop-Code Detection Criteria

| | |
|---|---|
| In-band Loop Codes: | Loop Up — Continuously transmitted until the code is received error-free for 250 ms or the switch is pressed a second time. |

| | |
|---|---|
| | Loop Down — Continuously transmitted until the code is no longer received or the switch is pressed a second time. |
| ESF Out-of-Band Loop Codes: | Not detectable. However, the loop codes are transmitted for only one second. |

### 11.14.9 DS1 Frequency Measurement

| | |
|---|---|
| Accuracy: | ±5 ppm. |
| Resolution: | 1 Hz. |

### 11.14.10 DS1 Timing Slips Measurement

| | |
|---|---|
| Range: | 0 bit slips to 999 frame slips and 192 bit slips. |
| Resolution: | 1 bit slip. |

### 11.14.11 DS1 Level Measurement

| | |
|---|---|
| Range: | +6 dBdsx to -40 dBdsx. |
| Accuracy: | ±1.0 dB between +6 dBdsx and -18 dBdsx.<br>±2.0 dB between -18 dBdsx and -40 dBdsx. |
| Resolution: | 0.1 dBdsx. |

### 11.14.12 VF Level Measurement

| | |
|---|---|
| Range: | +3 dBm0 to -50 dBm0. |
| Accuracy: | ±0.3 dBm. |
| Resolution: | 0.01 dBm. |

### 11.14.13 DATAPORT Interface

Connection: 9-position, 6-pin, female D connector.

Configuration: Synchronous DCE (transmit only).

Pin Assignments: See Table 11-4.

Data Format: DS0 or datalink.

Data Output: DS0 — 56 and 64 kb/s clear channel.
ESF — 4 kb/s datalink.
ESFz — 2 kb/s datalink.
SLC — 4 kb/s datalink and Fs bits (external decoding required).

Timing: Recovered clock from received data on DS1 RECEIVE jack. Attached test set must synchronize to clock source on Pin 9. Output is squelched until the instrument is synchronized with framing bits.

Control Level: +12 VDC for ON (0) and -12 VDC for OFF (1).

Output Signal Level: +12 VDC for a space (0) and -12 VDC for a mark (1).

Clock Signal Level: ±12 VDC.

**Table 11-4**
**DATAPORT Connector Pin Assignments**

| Pin # | Designation | Description |
|---|---|---|
| 1 | Signal Ground | Connected to signal ground. |
| 5 | Control | This lead is ON when the output signal (pin 6) is available. |
| 6 | Output Signal | This lead provides 64 or 56 kb/s DS0 channel, SLC-96 4 kb/s datalink, ESF 4 kb/s datalink, or ESFz 2 kb/s datalink signals. The output is controlled through the AUX DATAPORT function and **MODE** switch. |
| 9 | Clock Signal | This lead provides an external clock source for the attached test set. |

### 11.14.14 Voice Frequency Output

| | |
|---|---|
| Connection: | WECO 310 jack. |
| Jack: | Impedance — 600 ohms resistive.<br>Level — calibrated to dBm0 = 0 dBm. |

## 11.15 310-2 E1 DROP OPTION SPECIFICATIONS

This section contains the E1 output specifications for the E1 Drop Option.

| | |
|---|---|
| Connector: | Three-pin banana jack. |
| Impedance: | 120 ohms ±5%, balanced to ground. |
| Signal Level: | 3 V ±0.3 V. |
| Coding: | HDB3. |
| Pulse Shape: | Conforms to CCITT Recommendation G.703, Figure 15. |

## 11.16 310-3 DS1 INSERT OPTION SPECIFICATIONS

This section contains the specifications for the 310-3 DS1 Insert Option.

### 11.16.1 DS1 Insert Input Specifications

| | |
|---|---|
| Connector: | WECO 310 jack. |
| Frequency: | 1,544,000 Hz ±1000 Hz. |
| Impedance: | 100 ohms ±5%, balanced to ground. |
| Signal Level Range: | +6 to -6 dBdsx cable loss.<br>+6 to -26 dBdsx resistive loss. |
| Jitter Tolerance: | per AT&T PUB62411, 1983. |

### 11.16.2 Secondary DS3 Receive Specifications

| | |
|---|---|
| Connector: | WECO 560A jack. |
| Frequency: | 44.736 Mb/s ±1000 Hz. |
| Impedance: | 75 ohms ±5%, unbalanced to ground. |
| Line Code: | B3ZS. |

## 11.17 310-4/A SONET DROP OPTION SPECIFICATIONS

This section contains the specifications for the 310-4 and 310-4A SONET Drop Options.

### 11.17.1 STS-1 Input Specifications

| | |
|---|---|
| Connector: | WECO 560A jack. |
| Frequency: | 51.840 Mb/s, nominal. |
| Impedance: | 75 ohms ±5%, unbalanced to ground. |
| Signal Level Range: | DSX — Up to 3 dB of cable loss or 20 dB of resistive from a nominal DSX level.<br>HIGH — Up to 3 dB of cable loss or 20 dB of resistive from a nominal HIGH level. |

### 11.17.2 OC-1 and OC-3 Input Specifications

| | |
|---|---|
| Connector: | FC(PC). |
| Frequency: | OC-1 — 51.840 Mb/s, nominal.<br>OC-3 — 155.520 Mb/s, nominal. |
| Optical Wavelength: | 1300 nm, nominal. |
| Input Power Range: | -7.0 dBm to -35 dBm at $10^{-10}$ bit error rate. |

## 11.18 310-5 DS3 JITTER OPTION SPECIFICATIONS

This section contains the specifications for the 310-5 DS3 Jitter Option.

### 11.18.1 General Specifications

| | |
|---|---|
| Input Signal: | Jitter clock recovered from the PRIMARY DS3 RECEIVE INPUT jack. |
| Time Base Range: | 44.736 MHz ±4.4 kHz (= ±100 ppm). |
| Acquisition Time: | After a valid jitter clock is present: 2 to 4 seconds (typical), 12 seconds (maximum). |
| Amplitude Measurement Interval: | 0.25 seconds. |
| Warm-up Interval: | 3 minutes. |

### 11.18.2 Jitter Amplitude Measurements Specifications

| | |
|---|---|
| Dynamic Range: | 2 UI Scale — < 2.000 UI p-p.<br>5 UI Scale — < 5.00 UI p-p.<br>20 UI Scale — < 20.00 UI p-p. |
| Frequency Measurement Range: | See Figure 11-1. |
| Resolution: | 2 UI Scale — 0.005 UI.<br>5 UI Scale — 0.01 UI.<br>20 UI Scale — 0.02 UI. |
| Accuracy: | 2 UI Scale — ±5% ±0.05 UI.<br>5 UI Scale — ±5% ±0.125 UI.<br>20 UI Scale — ±5% ±0.5 UI. |
| Bandwidths: | Wideband — 10 Hz to 400 kHz, nominal.<br>Highband — 30 kHz to 400 kHz, nominal.<br>Filter slopes — 20 dB/decade. The filter response at the corner frequencies is nominally down 3 dB from the center of the passband. |

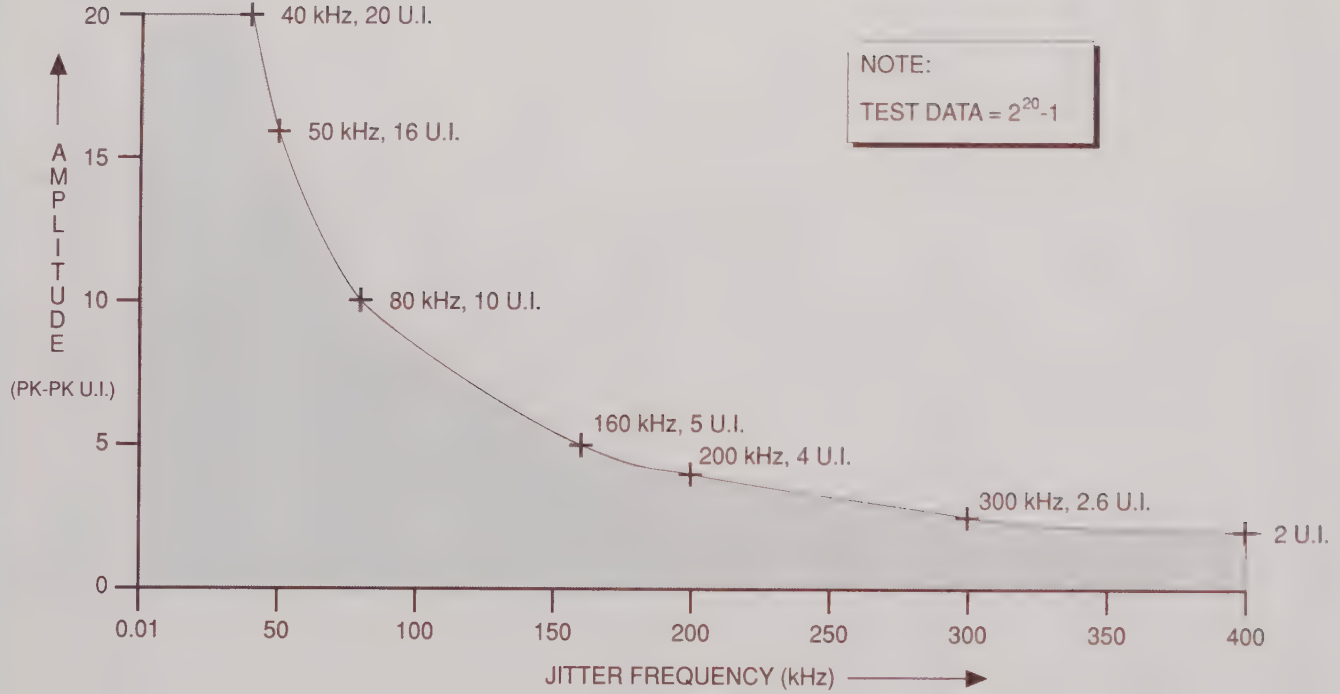



**Figure 11-1**
**DS3 Jitter Tolerance Mask**

### 11.18.3 Jitter Frequency Output Specifications

| | |
|---|---|
| Connector: | BNC. |
| Impedance: | 50 ohms. |
| Demodulated Analog Signal Output: | 2 UI Scale — 0.5 Vp-p/UIp-p.<br>5 UI Scale — 0.2 Vp-p/UIp-p.<br>20 UI Scale — 0.05 Vp-p/UIp-p. |
| Bandwidths: | Wideband — 10 Hz to 400 kHz, nominal.<br>Highband — 30 kHz to 400 kHz, nominal.<br>Filter slopes — 20 dB/decade. The filter response at the corner frequencies is nominally down 3 dB from the center of the passband. |

## 11.19 310-6 IEEE-488 OPTION SPECIFICATIONS

| | |
|---|---|
| Connector Type: | 24-pin, D-type. |
| Connector Configuration: | Addressable or Talk-Only. |
| Connector Pin Assignments: | See Table 11-5. |
| Maximum Transfer Rate: | 1200 bytes per second. |
| Terminator: | CR, LF, or CRLF. |

Table 11-5
IEEE-488 Connector Pin Assignments

| Pin No. | Description | Pin No. | Description |
|---|---|---|---|
| 1 | Data In/Out 1 (DI/O1) | 13 | Data In/Out 5 (DI/O5) |
| 2 | Data In/Out 2 (DI/O2) | 14 | Data In/Out 6 (DI/O6) |
| 3 | Data In/Out 3 (DI/O3) | 15 | Data In/Out 7 (DI/O7) |
| 4 | Data In/Out 4 (DI/O4) | 16 | Data In/Out 8 (DI/O8) |
| 5 | End or Identify (EOI) | 17 | Remote Enable (REN) |
| 6 | Data Valid (DAV) | 18 | Ground for twisted pair for 6 |
| 7 | Not Ready for Data (NRFD) | 19 | Ground for twisted pair for 7 |
| 8 | Not Data Accepted (NDAC) | 20 | Ground for twisted pair for 8 |
| 9 | Interface Clear (IFC) | 21 | Ground for twisted pair for 9 |
| 10 | Service Request (SRQ) | 22 | Ground for twisted pair for 10 |
| 11 | Attention (ATN) | 23 | Ground for twisted pair for 11 |
| 12 | SHIELD | 24 | Signal Ground |

## 11.20 310-10 G.821 RESULTS OPTION SPECIFICATIONS

Compatibility: Meets CCITT Recommendation G.821.

Available Results: Available seconds, % available seconds, severely errored seconds (except the 310-1), % severely errored seconds, consecutive severely errored seconds (except the 310-1), degraded minutes, % degraded minutes, and unavailable seconds.

# APPENDIX A
# FACTORY DEFAULT SETTINGS

# FACTORY DEFAULT SETTINGS

This appendix identifies the T-BERD 310 and 310-1 factory default settings for the switch positions and auxiliary functions that are stored in nonvolatile memory. To configure the T-BERD 310 and 310-1 with the factory default settings, press the **RESTART** switch for several seconds while first applying power.

**Table A-1**
**T-BERD 310 Factory Default Settings**

| Front Panel Switches | Default |
|---|---|
| AUX | OFF |
| BPV ERROR INSERT | OFF |
| DISPLAY HOLD | OFF |
| DS1 DROP CHANNEL | 28 |
| DS1 INSERT CHANNEL | No status |
| DS3 SOURCE | EXT |
| FRAME ERROR INSERT | OFF |
| HISTORY RESET | OFF |
| LOGIC ERROR INSERT | OFF |
| MODE | M13 |
| PATTERN | 2^23-1 |
| PRIMARY DS3 RECEIVE INPUT | DSX |
| PRIMARY DS3 TRANSMIT OUTPUT | DSX |
| PRINT EVENT | OFF |
| PRINT | N/A |
| RESTART | N/A |
| RESULTS I and II SECONDARY | OFF |
| RESULTS I/II Category | SUMMARY |
| TEST | CONT |
| TRANSMIT TIMING | INT |
| VOLUME | N/A |

Table A-1
T-BERD 310 Factory Default Settings (Continued)

| Auxiliary Functions | Default |
|---|---|
| ERR INSERT Auxiliary Group | |
| FRAME ERROR | 1/M-FRAME |
| LOG/BPV BUR | SINGLE |
| LOG/BPV RT | 1E-2 |
| ERR RECEIVE Auxiliary Group | |
| ERROR THR | 1E-2 |
| FRM LOSS THR | 3 OUT OF 15 |
| PAR ERR RT | BIT ERROR |
| PAT LOSS THR | FAST |
| MUXED TX Auxiliary Group | |
| DS1 LP CODE | CSU |
| PGM LPDN | 100 |
| PGM LPUP | 10000 |
| TIME Auxiliary Group | |
| SET DATE | Current date |
| SET TIME | Current time |
| TEST LENGTH | 01:00:00 |
| PRINT Auxiliary Group | |
| BAUD RATE | 2400 baud |
| CUSTOM | All selections OFF |
| FORMAT | NORMAL |
| GRAPH | N/A |
| INTERVAL | 06:00:00 |
| MODE | CONTINUOUS |
| PARITY | NONE |
| PORT | RS-232 |
| TERMINATOR | CR |
| WIDTH | 40 |
| MISC Auxiliary Group | |
| BEEP CRI | All OFF |
| BLU SIG CRI | STUCK C-BIT |
| DS1 LINECODE | AMI |
| PULSE MASK | NONE |
| TX X-BIT | 11 |
| USER1 | 100 |

**Table A-1**
**T-BERD 310 Factory Default Settings (Continued)**

| Auxiliary Functions | Default |
|---|---|
| FEAC ALARMS | All OFF |
| FEAC LOOP | All OFF |
| SONET Auxiliary Group | |
| SONET INPUT | STS-1 |
| DS1 DROP OUT | DS3 |
| SONET DS1 CH | 28 |
| STS RX LEVEL | DSX |
| JITTER Auxiliary Group | |
| JIT SCALE | AUTO |
| JIT FILTER | AUTO |

**Table A-2**
**310-1 Factory Default Settings**

| Front Panel Switches | Default |
|---|---|
| BPV ERROR INSERT | OFF |
| CODE | AMI |
| DISPLAY HOLD | OFF |
| DS0 DROP CHANNEL | 24 |
| DS1 SOURCE | DS3 DROP |
| HISTORY RESET | N/A |
| LOGIC ERROR INSERT | OFF |
| LOOP DOWN | OFF |
| LOOP UP | OFF |
| MODE | T1 |
| PATTERN | QRSS |
| RECEIVE INPUT | TERM |
| RESTART | N/A |
| RESULTS I/II Category | SUMMARY |
| TRANSMIT TIMING | INTERNAL |

Table A-2
310-1 Factory Default Settings (Continued)

| Auxiliary Functions | Default |
|---|---|
| USER1 | 100000 |
| PGM LPUP | 10000 |
| PGM LPDN | 100 |
| LP CODE | CSU/LINE* |
| ESF LOOP* | IN BAND |
| PRM, transmit/receiver* | OFF/ON |
| DATAPORT | DS0 |
| CUSTOM | All OFF |
| SLIP REF* | PRI DS3 DROP |

* Requires the 310-9A Enhanced ESF/DS1 Timing Slips Option.

# APPENDIX B
# OPERATING MESSAGES

# OPERATING MESSAGES

## B.1 INTRODUCTION

This appendix lists the printed status, alarm, and note messages; the messages that appear on the front panel; and error and warning messages generated during local and remote control operation. These messages are divided by mainframe and option.

## B.2 PRINTED STATUS, ALARM, AND NOTE MESSAGES

These messages are identified as status, alarm, and note messages that are generated automatically when an important condition occurs. The **PRINT EVENT** switch must be set to a selection other than OFF to generate these messages. The two-line message format includes the type of message (status, alarm, or note), time, date, the number of times the condition occurs (i.e., it keeps counting even if not reported) over the course of the test, and the message identifying the reported condition.

### B.2.1 Status Messages

The status messages indicate positive conditions in the received signal and relate to the Status LEDs. The Status messages start with the header "*** STATUS:".

#### T-BERD 310 Mainframe

***** STATUS: DS3 Primary C-Bit Frame Sync** — The DS3 C-bit parity framing format is detected in the Primary DS3 received signal.

***** STATUS: DS3 Primary DS2 Frame Sync** — The DS2 framing format is detected in the Primary DS3 received signal.

***** STATUS: DS3 Primary Frame Sync** — The DS3 framing format is detected in the Primary DS3 received signal.

***** STATUS: DS3 Primary Idle Detect** — The DS3 Idle Signal is detected in the Primary DS3 received signal.

***** STATUS: DS3 Primary Pattern Sync** — The DS3 test pattern is recognized in the Primary DS3 received signal.

***** STATUS: DS3 Primary Signal Present** — DS3 pulses of a valid frequency and level are present in the Primary DS3 received signal.

### 310-1 DS1/DS0 Analyzer Option

***** STATUS: DS1 B8ZS Detect** — B8ZS encoding is detected in the received DS1 signal.

***** STATUS: DS1 Frame Sync** — The DS1 framing format is detected in the received DS1 signal.

***** STATUS: DS1 Pattern Sync** — The DS1 test pattern is recognized in the received DS1 signal.

***** STATUS: T1 Pulses** — DS1 pulses of a valid frequency and level are present in the received DS1 signal.

### 310-3 DS1 Insert Option

***** STATUS: DS3 Secondary C-Bit Frame Sync** — The DS3 C-bit parity framing format is detected in the Secondary DS3 received signal.

***** STATUS: DS3 Secondary DS2 Frame Sync** — The DS2 framing format is detected in the Secondary DS3 received signal.

***** STATUS: DS3 Secondary Frame Sync** — The DS3 framing format is detected in the Secondary DS3 received signal.

***** STATUS: DS3 Secondary Idle Detect** — The DS3 Idle Signal is detected in the Secondary DS3 received signal.

***** STATUS: DS3 Secondary Signal Present** — DS3 pulses of a valid frequency and level are present in the Secondary DS3 received signal.

### 310-4 or 310-4A SONET Drop Option

***** STATUS: SONET Present** — The SONET signal is detected in the received signal.

## B.2.2 Alarm Messages

The alarm messages indicate negative conditions in the received signal and relate to the current Alarm LEDs. The Alarm messages start with the header "*** ALARM:".

### T-BERD 310 Mainframe

***** ALARM: DS3 Primary Blue (AIS)** — The DS3 Blue Alarm is detected in the Primary DS3 received signal.

***** ALARM: DS3 Primary DS2 Frame Loss** — The DS2 framing format is no longer present in the Primary DS3 received signal.

***** ALARM: DS3 Primary Far-End Alarm** — The T-BERD 310 is receiving a DS3 Far-End Alarm and Control (FEAC) condition in the Primary DS3 received signal. Refer to Section 3.11 for information on the specific FEAC messages that appear in the SUMMARY category.

***** ALARM: DS3 Primary Frame Loss** — The DS3 framing format is no longer present in the Primary DS3 received signal.

***** ALARM: DS3 Primary Pattern Loss** — The DS3 test pattern is no longer present in the Primary DS3 received signal.

***** ALARM: DS3 Primary Signal Loss** — Valid DS3 pulses are no longer present in the Primary DS3 received signal.

***** ALARM: DS3 Primary Yellow** — The DS3 Yellow Alarm is detected in the Primary DS3 received signal.

### 310-1 DS1/DS0 Analyzer Option

***** ALARM: DS1 All Ones** — An All Ones pattern is detected in the received DS1 signal.

***** ALARM: DS1 Excess Zeros** — Excess zeros are present in the received DS1 signal.

***** ALARM: DS1 Frame Loss** — The DS1 framing format is no longer present in the received DS1 signal.

***** ALARM: DS1 Pattern Loss** — The DS1 test pattern is no longer present in the received DS1 signal.

***** ALARM: DS1 Signal Loss** — Valid DS1 pulses are no longer present in the received DS1 signal.

***** ALARM: DS1 Yellow Alarm** — The DS1 Yellow Alarm is detected in the received DS1 signal.

### 310-3 DS1 Insert Option

***** ALARM: DS3 Secondary Blue (AIS)** — The DS3 Blue Alarm is detected in the Secondary DS3 received signal.

***** ALARM: DS3 Secondary DS2 Frame Loss** — The DS2 framing format is no longer present in the Secondary DS3 received signal.

***** ALARM: DS3 Secondary Far-End Alarm** — The T-BERD 310 is receiving a DS3 Far-End Alarm and Control (FEAC) condition in the Secondary DS3 received signal. Refer to Section 3.11 for information on the specific FEAC messages that appear in the Secondary SUMMARY category.

***** ALARM: DS3 Secondary Frame Loss** — The DS3 framing format is no longer present in the Secondary DS3 received signal.

***** ALARM: DS3 Secondary Signal Loss** — Valid DS3 pulses are no longer present in the Secondary DS3 received signal.

***** ALARM: DS3 Secondary Yellow** — The DS3 Yellow Signal is detected in the Secondary DS3 received signal.

### 310-4 or 310-4A SONET Drop Option

***** ALARM: SONET Loss** — The SONET signal is no longer detected in the received signal.

## B.2.3 Note Messages

The note messages indicate conditions affecting the operation of the T-BERD 310. The Note messages start with the header "*** NOTE:".

## T-BERD 310 Mainframe

***** NOTE: DS2 Test Restart —** A DS2 test restart occurred on the T-BERD 310 when the DS1 channel and DS2 M-frame was changed.

***** NOTE: DS3 New Configuration —** The configuration of the T-BERD 310 has been modified.

***** NOTE: DS3 Test Complete —** The end of a timed test has been reached on the T-BERD 310.

***** NOTE: DS3 Test Restart —** A test restart occurred on the T-BERD 310.

***** NOTE: Print Buffer Full —** The T-BERD 310 print buffer has overflowed. When the message appears, at least one printout has been lost (discarded). There is no date and time associated with this note message.

***** NOTE: Squelch Off —** The generation of 5 or less errored second, alarm, note, or status print requests occurred during the previous 60 seconds while the printer squelch was on.

***** NOTE: Squelch On —** More than 20 errored second, alarm, note, or status printouts have been generated within 60 seconds. The printer squelch is turned on and no more messages or automatic ERR SEC result printouts are printed or stored.

## 310-1 DS1/DS0 Analyzer Option

***** NOTE: DS1 New Configuration —** The configuration of the 310-1 has been modified.

***** NOTE: DS1 Test Complete —** The end of a timed test has been reached on the 310-1.

***** NOTE: DS1 Test Restart —** A test restart occurred on the 310-1.

## B.3 FRONT-PANEL MESSAGES

Operating messages provide visual indications of the condition of the instrument and the received signal. Some messages are displayed once and others flash until the cause of the condition is changed or corrected. The messages are defined in alphabetical order as follows:

### T-BERD 310 Mainframe

**232 REMOTE CONTROL** — This message is flashed when the unit is under remote control. This message alternates with the displayed results and operating status. This message is disabled by exiting the remote control mode and returning to local control.

**488 REMOTE CONTROL** — This message is flashed when the unit is under remote control. This message alternates with the displayed results and operating status. This message is disabled by exiting the remote control mode and returning to local control. This message only appears when operating from the 310-6 IEEE-488 Option interface.

**DS2 TEST RESTART** — This message is flashed when the **DS1 DROP CHANNEL** switch changes the DS1 channel from one DS2 M-frame to another.

**OPTION NOT INSTALLED** — This message is displayed when an option, which is not currently installed, is required for a switch to operate properly.

**SIGNAL LOSS** — This message is flashed when the unit loses the DS3 signal.

**TIMED TEST COMPLETE** — This message is displayed when a timed test is finished. This message is disabled by setting the **TEST** switch to CONT, or by pressing the **RESTART** switch. This message is flashed alternating with the displayed results and operating status.

### 310-1 DS1/DS0 Analyzer Option

**SIGNAL LOSS** — This message is flashed when the 310-1 loses the DS1 signal.

**TEST COMPLETE** — This message is displayed when a timed test is finished. This message is disabled by setting the **TEST** switch to CONT, or by pressing the **RESTART** switch. This message is flashed alternating with the displayed results and operating status.

## B.4 REMOTE CONTROL MESSAGES

The following error and warning messages appear when entering commands and/or parameters incorrectly. Error messages are formatted with the prefix "*****ERROR**" or "*****WARNING**", the message indicates the problem, and in some cases the improperly entered command or parameter.

*****ERROR: Bad command syntax.** — The **command_name** was entered improperly. Reenter the first three characters of the **command_name** or as required. See the **HELP !** command for a list of valid **command_names**.

*****ERROR: Bad configuration parameter: xxxxx** — The indicated **[parameter]** was an invalid parameter for the setup configuration. Reenter the entire command string with the correct **[parameter]**. See the **HELP <command>** command for a list of valid **[parameters]**.

*****ERROR: Bad parameter: xxxxx** — The indicated **[parameter]** was entered improperly. Reenter the entire command string with the correct **[parameter]**. See the **HELP <command>** command for a list of valid **[parameters]**.

*****ERROR: Framing errors insertion not allowed in unframed mode.** — Attempted to insert framing errors in the UNFRAMED mode. Either do not insert framing errors in the UNFRAMED mode or change the operating mode.

*****ERROR: Framing errors not allowed in DS1 INSERT mode.** — Attempted to insert framing errors in the DS1 INSERT mode. Either do not insert framing errors in the DS1 INSERT mode or change the operating mode.

*****ERROR: No such command: xxxxx** — The indicated **command_name** is not a valid command. See the **HELP !** command for a list of valid **command_names**.

*****ERROR: No such help page: xxxxx** — The indicated help page is not valid. See the **HELP** command for a list of valid page names and numbers.

*****ERROR: Not enough command words specified.** — The **command_name** is incomplete. See the **HELP !** command for a list of valid **command_names**.

*****ERROR: Not enough letters specified.** — The **command_name** does not have enough characters entered. See the **HELP <command>** command for a list of valid **command_names** or **[parameters]**.

*****ERROR: OPTION NOT INSTALLED** — Option-specific text was detected. The previous command is only valid when the appropriate option is installed.

*****ERROR: Parameter out of range: xxxxx** — The previous **[parameter]** exceeds the command parameter limits. Reenter the entire command string with the correct **[parameter]**. See the **HELP <command>** command for a list of valid **[parameters]**.

*****ERROR: Parameter(s) required** — The **command_name** requires a **[parameter]**. See the **HELP <command>** command for a list of valid **[parameters]**.

*****ERROR: Pattern not supported by current mode** — The previous test pattern is not valid for the current operating mode. Change either the test pattern or operating mode. Refer to Section 3, 8, 9, 10, or 11 for test pattern and operating mode exceptions.

*****ERROR: Remote Control cannot modify this setting** — An attempt was made to modify the **PRInt PARity** or **PRI BSUd RATe** command.

*****ERROR: Result not applicable to current configuration** — The selected test result does not apply to the current configuration. See the **PRI**, **RES1**, or **RES2** command. Refer to Section 3, 8, 9, 10, or 11 for test result exceptions.

*****ERROR: Result not currently available** — The selected test result is not available. See the **PRI**, **RES1**, or **RES2** command. Refer to Section 3, 8, 9, 10, or 11 for test result exceptions.

*****ERROR: Result not supported by current ROM revision** — The current software does not support the selected test result. Refer to Section 3, 8, 9, 10, or 11 for test result exceptions.

*****ERROR: Screen name too long: xxxxx** — The indicated help screen name is longer than the longest valid help screen name. See the **HELP** command for a list of valid screen names and numbers.

*****ERROR: Too many command words specified** — The **command_name** is too long. See the **HELP !** command for a list of valid **command_names**.

*****WARNING: Current configuration forces recovered timing mode** — The transmit timing mode was changed to either internal or external and the configuration requires recovered timing. The instrument defaults to recovered timing. Refer to Section 3, 8, 9, 10, or 11 for transmit timing exceptions.

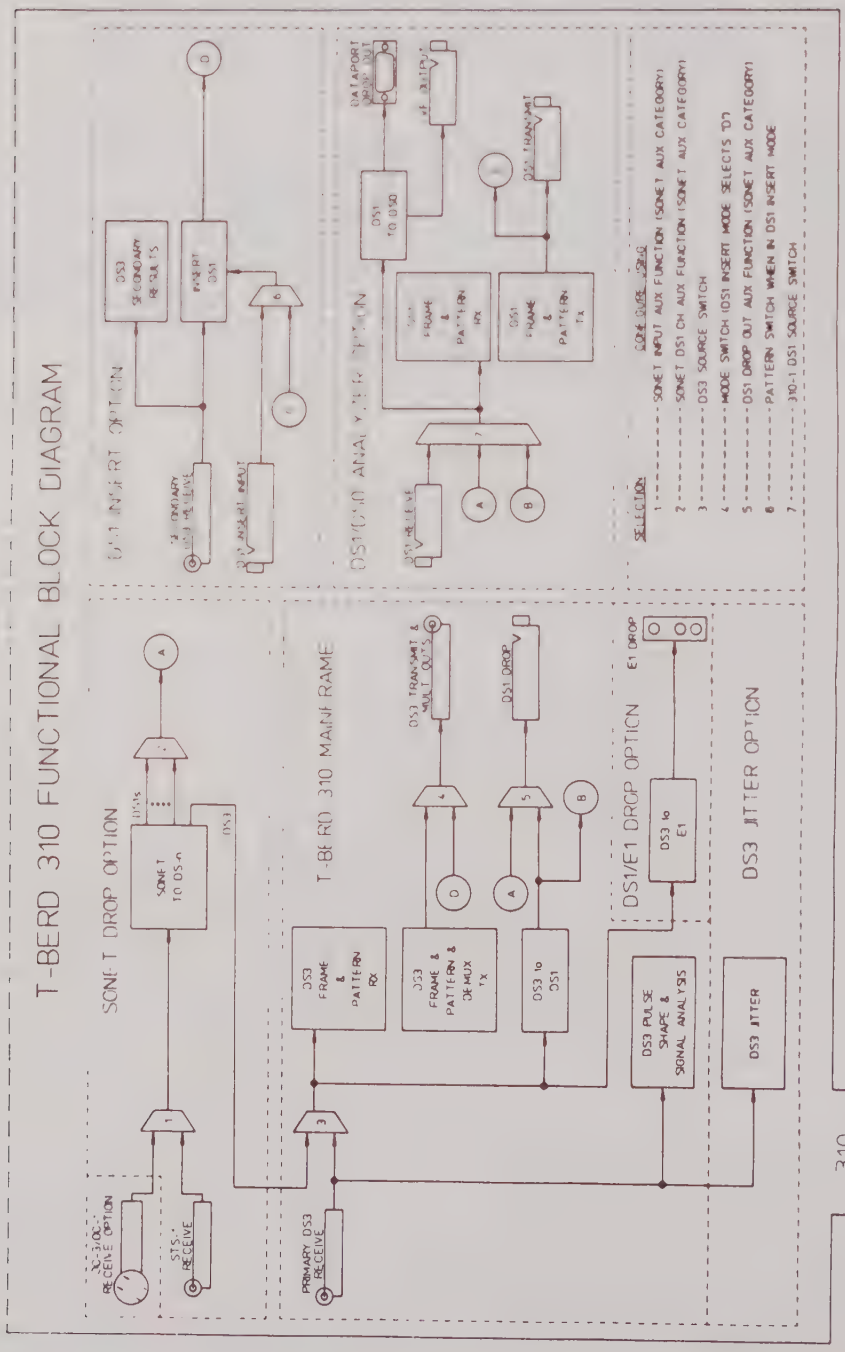
*****WARNING: That operation is not relevant to the current mode** — The previous operation does not apply to the current operating mode. The operation succeeded, but it has no effect on the current mode. Refer to Section 3, 8, 9, 10, or 11 for operating mode exceptions.

# APPENDIX C
# FUNCTIONAL BLOCK DIAGRAM

# T-BERD 310 FUNCTIONAL BLOCK DIAGRAM

The T-BERD 310 Functional Block Diagram provides a quick and easy reference for following each SONET, DS3, DS1, and DS0 signal path throughout the T-BERD 310. The diagram shows signal input jacks and the functions that can be performed on each signal. The diagram also indicates the functional locations where lower level channels can be dropped from higher level signals (e.g., dropping a DS1 channel from a DS3 signal). Front-panel switches or auxiliary functions required to make any selections are identified on the diagram.

The functional block diagram can be found on the T-BERD 310 help card.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5 ---------- DS1 DROP OUT AUX FUNCTION (SONET AUX CATEGORY)
6 ---------- PATTERN SWITCH WHEN IN DS1 INSERT MODE
7 ---------- J10-1 DS1 SOURCE SWITCH
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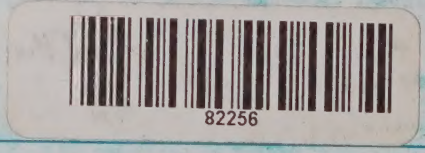
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